ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LIV, No. 7. CHICAGO, SATURDAY, FEBRUARY 13, 1909. ISSUED WEEKLY

BY THE
ELECTRICAL REVIEW PUBLISHING COMPANY.
CHARLES W. PRICE, President.
H. S. TUTHILL, Secretary. PHILIP S. DODD, Manager.
C. W. FORBRICH, Assistant Treasurer.

PUBLICATION OFFICE: 204 DEARBORN STREET, CHICAGO.

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
E. E. Wood.
EUROPEAN OFFICE . . . . . 42 Old Broad Street, London, E. C.
Henry W. Hall.

A. A. GRAY, Managing Editor.

The present publication comprises: ELECTRICAL REVIEW, VOL. LIV, No. 7; WESTERN ELECTRICIAN, VOL. XLIV, No. 7.

SUBSCRIPTIONS

One Year, United States	$3.00
One Year, Canada	4.00
One Year, Foreign Countries	6.00
Single Copy, 10 cents. Back numbers, beyond one month, each	.25

Changes of address reaching this office later than Monday cannot be made until the issue next following.

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS

EDITORIAL:
- A Field for Electric Street Lighting 285
- Power Costs in a Moderate-Capacity Central Station 286
- Increased Costs in Electric-Railway Operation 287
- The Chicago Automobile Show 287
- Fan Motors for 1909 287

Connecticut River for Electric Power 288
Dr. Steinmetz Will Discuss Prime Movers 289
Alternating Currents and Their Applications, by Edson R. Wolcott .. 290
Automatic Brake for Runaway Car 291
American Society of Mechanical Engineers 291
Operating Results from a Sixty-Cycle Gas-Driven Power Station, by J. R. Bibbins 292
Telephone Legislation in Texas 298
Electrical Inspection Law for Philadelphia 298
New German Electric Railway 298
Profit-Sharing Plan Offered Employes of Large Electric Railway and Lighting Company 299
Annual Dinner of the American Institute 299
Mechanical and Electrical Engineers 299
Telegraphs in the United States 299
Two Unique Gasolene-Electric Autotrucks 300
Electrical Section, Western Society of Engineers 301
Coming Technical Society Meetings in New York 301
Hudson River Electric Power Company 302
Electric Smelting Furnaces in Sweden 302
Electrical Contractors' Association at Toledo 302
Editors Inspect New Haven System 302
Westinghouse Company Turns Over New Haven Electrification 302
Electrical Notes from Great Britain 303
Ohio Electric Light Association 304
Electrical Show for Louisville 304
Westinghouse Company Restores Scale of Wages 304
Hudson-Fulton Celebration 305
Effect of Texas Legislation on Telephone Revenues 305
Navy Department Supplies 305
Power from Coke-Oven Gas 306
New York Electrical Society 306
The Golden West and American Industries Exhibition 306
Electrical Exports for December 307
Cheaper Aluminum in Sight 307
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 308
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE 310
INDUSTRIAL SECTION:
- American Supply and Machinery Manufacturers' Association 312
- The Harrison Universal Photometer 312
- A Motor-Driven Table Saw 313
- The Manufacture of Nippers and Pliers 313
- Electric Fans for 1909 314

CURRENT ELECTRICAL NEWS 323
DIRECTORY OF ELECTRICAL AND ALLIED ENGINEERING AND SCIENTIFIC SOCIETIES 328
RECORD OF ELECTRICAL PATENTS 330

Copyright, 1908, by Electrical Review Publishing Co.

A FIELD FOR ELECTRIC STREET LIGHTING.

Mantle gas burners now do much street lighting that would make paying loads of tungsten lamps for electric stations.

In one large city, where several thousand electric arc street lamps are in use, there are also about 11,000 mantle gas lamps, nearly all of the single-burner type, and the rate for these single-burner lamps is $29 each, burning 3,900 hours per year.

Another smaller city, with nearly 800 electric arc lamps on the streets, uses also about 550 single-mantle lamps at the rate of $28.50 per gas lamp per year of 4,000 hours' use.

In each of these cities the gas and electric companies are independent of each other.

The rates for single-mantle gas street lamps usually range between $24 and $32 for a year with 4,000 hours of burning, or from 0.6 to 0.8 cent per lamp-hour, these prices covering the gas, the lighting and the repair of the lamps. A single-mantle gas lamp such as is generally used on the streets is rated to consume about 3.5 cubic feet of gas per hour, so that the cost of gas at $1 per thousand feet is 0.35 cent per hour, or $14 per year with 4,000 hours of burning. It is a peculiar feature of the business that these mantle gas lamps are not usually operated by the gas companies, but are furnished and maintained by one of the several companies that contract for street lighting all over the country, and buy gas from the local plants.

These facts as to the gas consumed and as to the division of the business between the gas companies and outside contractors obviously have a bearing on the ability to withstand the competition of tungsten lamps.

As the gas mantles when new and supplied with good gas at the rate above named give about fifty horizontal candlepower, it has been hard to compete with them with carbon incandescent lamps in street lighting. For a fifty-candle series carbon lamp the power would be at best 150 watts, and if the charge for operating and renewing this lamp were ten cents per kilowatt-hour, the cost to the city served would be 1.5 cents per lamp-hour. This figure shows why it has been hard to compete with the gas-mantle lamp at 0.6 to 0.8 cent per hour.

With tungsten lamps the situation is quite different, for the sixty-candle size requires only seventy-five watts, costing a municipality 0.75 cent per lamp-hour, on the basis of ten cents per kilowatt-hour for the service. Lamps at the list price of $1.50 each, with an average life of 1,000 hours, make the cost 0.15 cent per hour for the lamp alone; that is, for lamp renewals, and there remains 0.6 cent per hour or eight cents per kilowatt-hour for the energy on the ten-cent basis.

A very large amount of street lighting is now done with

both arc and incandescent lamps, where the rate for the entire service is less than eight cents per kilowatt-hour of energy used. It is not perhaps unreasonable to assume, therefore, that a rate of eight cents per kilowatt-hour for the energy used, plus the cost of renewals, will make it well worth while to replace gas mantles with tungsten street lamps.

The usual rates of 0.6 to 0.8 cent per hour for mantle gas lamps is about one-half eaten up by the cost of gas alone, and all other charges, including the cost of lighting and extinguishing, must come out of the other half. Finally the profit is divided between two parties.,

In the large city above mentioned, 11,000 tungsten street lamps of sixty candles each at $29 per lamp per year would yield a revenue of $319,000 from a load of 825 kilowatts, or $386 per kilowatt-year.

POWER COSTS IN A MODERATE-CAPACITY CENTRAL STATION.

Some figures of the cost of power in a moderate-capacity central station have just come to hand for a four-year period ending in 1908. They emphasize the point that a station equipped with apparatus of long-established design may yet produce electricity with reasonable efficiency, provided the load conditions are favorable. The plant in mind, unlike most central stations in its territory, disposes of most of its output in the power field. The lighting business of the station remains to be developed along much broader lines, and if a well-rounded load can be secured there is little question that the unit cost of power can, with the present equipment, be brought down to compare favorably with the results obtained in much larger installations.

Reviewing the equipment and conditions of production in this station for the year 1905, the company then operated one 125-horsepower and nine 150-horsepower shell boilers at a pressure of about 110 pounds. There were six engines in the station, comprising four different makes, and in all cases but one being of the compound condensing type. The engines ranged in individual horsepower from 100 to 1,250, and two were direct-connected to generators. In the plant as a whole there were fifteen generators, thirteen being run belted. The total dynamo capacity was 2,158 kilowatts, and the engine total rating was 2,750 horsepower. It is interesting to note that in the four years this equipment underwent no change whatever, and the labor list required for operation remained the same as to power-house positions on the payroll. Another peculiar feature of the plant's history is that during this time the total energy produced and sold increased very little, and in some years decreased. The load on the station was very largely for electric-railway service, with very little expansion in any direction. These stationary conditions do not, of course, represent a central-station ideal, but in their novelty they afford a special opportunity to examine the reasons for the variation in power cost notable in the plant during the period selected for study.

The total energy manufactured in the plant in 1905 was 4,211,088 kilowatt-hours, and of the total sales of 4,193,369 kilowatt-hours, the company turned 3,649,145 kilowatt-hours over for railway service. The fuel burned was a mixture of soft coal and screenings, the consumption of the former being 3,086 tons, at an average cost of $4.32, and of the latter, 5,301 tons (buckwheat), costing $2.85 per ton. The station operating force consisted of three engineers, three firemen, two coal passers and five helpers. The total cost of manufacture for the year was $45,183, or 1.07 cents per kilowatt-hour. The principal item of expense was fuel, which came to 0.675 cent per kilowatt-hour, the total bill amounting to about $2,300 per month. The labor cost per kilowatt-hour generated was 0.227 cent. The steam-plant repairs came to $2,511 and electric-plant repairs to $2,269, their total being about half the labor cost per unit of energy produced.

The cost of manufacture in 1906 per kilowatt-hour was also 1.07 cents. The cost of coal increased about $1,200, to 0.715 cent per unit. In this year the percentage of buckwheat screenings in relation to the bituminous coal was considerably increased. The soft coal used was 1,943 tons, and the hard coal 7,155 tons. Each kind increased from five to six cents per ton in cost. It is evident from the operating results secured that the change in the proportions of the fuel used had comparatively little effect on the station economy as a whole. The output of the plant fell off to 4,101,696 kilowatt-hours, and the power sales were slightly decreased. The principal saving in the total cost of power during the year was in electric-plant repairs, which fell off about $1,500 to $753.

The figures of 1907 show a marked increase in the cost of production, both per unit and in toto. The plant output dropped to 4,060,261 kilowatt-hours, and the power sales to 3,492,879 kilowatt-hours. The fuel proportions of the first year were again tried, but the coal cost per kilowatt-hour rose to 0.932 cent. This was largely due, however, to the price of coal per ton, which reached an average of $4.62 for the year on the soft grade and $2.94 for the screenings. The company burned 3,628 tons of soft and 7,193 tons of buckwheat. The total fuel cost increased by about $8,700. The labor cost did not change materially, the figure for the year being $9,712, or 0.239 cent per kilowatt-hour. The total power cost was $55,000, or 1.35 cents per unit, an increase of twenty-six per cent over each of the preceding years. An additional factor in the rise of expenses was an increase of $1,400 in steam and electric-plant repairs.

In 1908 a slight improvement in conditions was manifested by a fall in the total cost of power to 1.27 cents per kilowatt-hour manufactured. There was an increase in the output to 4,305,000 kilowatt-hours, and a gain in the power sales to about 3,672,000 units. The company burned 2,122 tons of bituminous coal, costing about $4.73, and 8,515 tons of screenings at $3.26. The total fuel cost was about $150 less than in the preceding year, and the fuel expense per unit was 0.876 cent. The labor cost per kilowatt-hour was 0.224 cent. Plant repairs were about the same as in 1907, and the total cost of production was practically the same as in the year quoted.

Surveying the entire period, the most trying feature which the plant has had to face has been the gradual rise in the price of coal, both soft and hard. In the former case a gain of 11.8

per cent is apparent; in the latter a gain of 14.4 per cent has taken place. The fuel cost per kilowatt-hour has been increased more rapidly, however, by other causes than the actual price of coal per ton, since there has been a gain of about thirty-three per cent in the total fuel expense per unit. It is fairly apparent, in view of the small increase in the load on the station, and consequent absence of improved load-factor natural in plants where the output is progressively growing, that the lessened economy of the station is due in considerable part to the retention of belted equipment of more or less antiquated design, which is now feeling the effects of inevitable depreciation and consequent loss of the highest efficiency of production. As was first noted, excellent economy may be obtained in a well-loaded station, even with old equipment, but the time is certain to come when modern apparatus of the best type will be the requirement of continued station economy of a high degree.

INCREASED COSTS IN ELECTRIC-RAILWAY OPERATION.

Electric railways have felt the increased cost of living as well as private individuals during the past ten years, and in some cases the rise in legitimate expenses has necessitated the somewhat radical solution of the dividend problem by passing to the six-cent fare as a standard. Massachusetts is at present studying these questions with great care in the field and before the Railroad Commission in cases where companies have asked approval of higher fares, or where the public has appealed to this tribunal against a raise in tariff.

Some typical figures illustrating how the cost of operation has risen were presented recently at a public hearing before the Railroad Commissioners by the Northampton Street Railway Company. The situation is clearer from the fact that since 1901 the company has not extended its system. During these seven years the company's gross income has increased only $27,000. Operating expenses, taxes and interest have increased $29,000, and the total investment necessary to handle the business and give fresh and enlarged accommodations demanded by the public has risen $32,000. Wages, coal and supplies cost the company thirty-three per cent more than ten years ago, and the total cost of carrying a passenger, plus taxes and interest, has risen from 4.41 cents to 4.59 cents. The revenue per car-mile has increased from 18.87 cents to 21.34 cents. If it were not for the question of depreciation and extraordinary replacements, it would not be as difficult a matter to pay the usual dividends, but it was shown by the company that these extraordinary expenses to meet the needs of the coming year will probably amount to $67,000, to be utilized for new boilers under a new boiler law, new cars, damages, new trolley wire and new signals. In the past thirteen years the company's income per car-mile has increased less than two per cent, while the operating cost per car-mile has gone up forty-five per cent. These facts emphasize the necessity of making all proper allowances in determining what the fares shall be in specific cases, particularly in the direction of that deterioration of plant which cannot be offset by the processes of ordinary maintenance.

THE CHICAGO AUTOMOBILE SHOW.

The annual Chicago Automobile Show, which was held from February 6 to February 13 at the Coliseum and at the First Regiment Armory, was opened last Saturday evening with a fine display of automobiles, motor cycles, accessories, material and machinery. Automobile manufacturers claim that the present year is going to be a banner one, and certainly from the interest manifested in the various exhibits, it would seem that their expectations will be realized. There was a very comprehensive showing of motor accessories, new ideas in ignition and timing systems being displayed prominently, and the battery manufacturers were well represented.

The distinctive and graceful lines of the electric carriages attracted a great deal of attention, and the interest manifested in these machines augurs well for a wide extension of the usefulness of the electric carriage. With associations of automobile manufacturers already well organized, and central stations, motor and battery manufacturers tied together by bonds of commercial enterprise, it seems hard to realize why they cannot get together and establish some comprehensive scheme where arrangements could be made for charging stations in at least all of the large cities and in most of the small cities where electricity is now used in any form. The electric automobile is a thing of beauty, and could be made one of great utility. The motors and the batteries are perfect mechanisms, central stations are in need of the load, and the only thing that appears to be in the way of a remarkable taking up of the electric automobile idea is the lack of intelligent co-ordination of the various industries represented.

FAN MOTORS FOR 1909.

On other pages of this issue there are described and illustrated some of the offerings of manufacturers in fan motors for the present season. As in other lines of electrical manufacturing, the fan motor has been the subject of continued improvement; and while, several years ago, it was recognized as a standard article of great merit and utility, there has been much effort directed recently toward effecting refinements in design and simplicity of connections, in order to render these machines capable of being set up and maintained by comparatively inexperienced persons. Each year, also, has shown fewer changes in design and type, and this year the only changes which are marked are in the form of oscillating fans or devices for changing the direction of the wind driven off from the fan blades. The direct blast of air sometimes has its disadvantages, and, whether properly or not, the public seems to have taken a fancy to those fan motors which distribute their breezes over a comparatively great area. Noiselessness of operation, freedom from vibration, and the building of smaller sizes of fans for residence and sick-room work, are also to be marked.

It is expected that the coming season will be the best which manufacturers of fan motors have ever experienced. The educational campaign which central stations and supply houses have been carrying on vigorously has awakened a keen interest in the possibilities of the electric fan, and this interest will materialize in a large increase in the demand for this apparatus.

Connecticut River for Electric Power.

BY ALTON D. ADAMS.

Massachusetts has only two large rivers, the Connecticut and the Merrimac.

On the Merrimac River, nearly all of the more important power sites have been developed, so that the Bay State can expect little more from it in the way of electrical supply.

While the state has a number of smaller rivers, like the Blackstone, Chicopee and Housatonic, these streams are quite generally devoted to local industries, and afford little surplus power for transmission to distant points.

Meantime, the majority of the cities of the state have little or no waterpower. In this situation, the Connecticut River, because of its largely undeveloped condition, is being considered as a possible important source of electric energy for transmission over parts of the state.

The Connecticut River flows from Connecticut Lake, in northern New Hampshire, to Long Island Sound, a distance of 345 miles, and falls 1,618 feet on the way. Along its entire course the Connecticut drains an area of 11,085 square miles, and has many small tributaries, but is the outlet of no large lakes or storage basins.

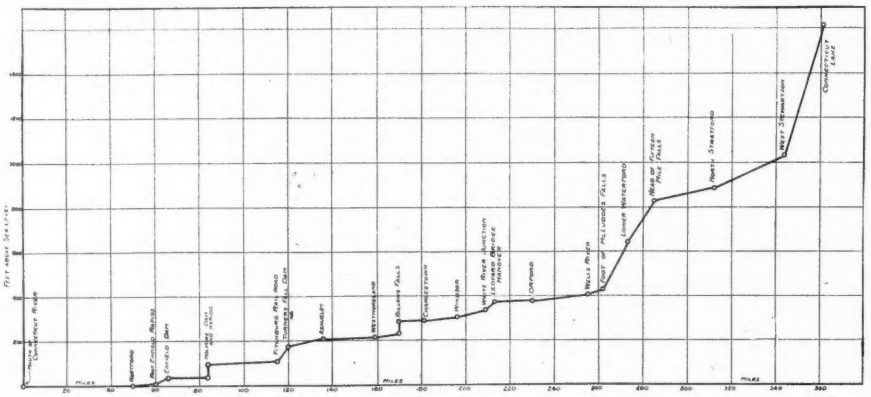
Within Massachusetts, the greater part of the available fall of the Connecticut River has been developed, but a material portion of it is still doing no useful work, and the same is true of the Nutmeg State. Along the boundary of New Hampshire and Vermont, however, for about 150 miles, the Connecticut River presents a series of large waterpower sites that have thus far been developed to only a small extent.

Increasing effort is now being directed to the development of electric power along the Connecticut in all four of the states through and past which it flows. One company has recently sought Federal authority to develop the power of the river north of Hartford, in Connecticut, for purposes of electrical supply. Another company has been chartered by the Massachusetts Legislature to erect a hydroelectric plant on the undeveloped part of the river in this state, and a third company is building a large dam between Vermont and New Hampshire to generate power for an electric transmission system.

Most of the population of Massachusetts is within about 100 miles of the Connecticut River. Boston is just about 100 miles away, and so is Haverhill. Lowell and Lawrence are less than ninety miles distant. Fitchburg, Worcester, Pittsfield and North Adams are each less than sixty miles from the river, while Springfield, Holyoke and Northampton are on its banks.

With the above facts in view, the following data bearing on the power that may be developed by the Connecticut for purposes of electric transmission have been collected. This power mainly depends, of course, on the available falls in the river, and on the amount of its discharge that can be utilized to advantage.

As may be noted from the profile, the Connecticut River is tidal as far as Hartford, fifty miles from its mouth, and along the next ten miles, below the foot of Enfield rapids, there is a fall of only six feet. From the foot of these rapids to the top of the Enfield dam, six miles upstream, the rise is thirty-two feet, and it is on this part of the river that the proposed hydroelectric plant is to be located.



PROFILE OF CONNECTICUT RIVER FOR A LENGTH OF 360 MILES.

From the foot of the Enfield rapids, where the fall of thirty-two feet can be made available, the distance is ten miles to Hartford and about eighty miles to New Haven, while Springfield is less than twenty miles away.

Above the Enfield dam the Connecticut River shows only slight change in level until the rapids at Holyoke are reached, some eighteen miles upstream, and these rapids with the Holyoke dam give a total fall of about sixty feet. Most of the developed power at Holyoke is devoted to the large manufacturing plants there, as is well known, water being distributed to the wheels through three canals at different levels. Besides the municipal electric plant at Holyoke, operated in part by water power, there is a hydroelectric plant devoted especially to power purposes, with an installed capacity of 1,200 kilowatts in generators connected to waterwheels, and 500 kilowatts in a generator driven by a steam turbine, but the output of this plant appears to be absorbed locally.

In the municipal electric plant at Holyoke are generators of 800-kilowatts total capacity driven by waterpower, but the output of these generators, as well as that of 1,650 kilowatts in steam-driven units, is devoted to light and power in that city.

Passing upstream from the top of the Holyoke dam to the top of the Turners Falls dam, thirty-six miles above, there is a rise of seventy-five feet, but sixty-four feet of this rise occurs at the Turners Falls dam and along the rapids for a distance of five miles below. The greater part of the power developed at the Turners Falls dam is devoted to local manufacture, but some of the energy from a hydroelectric station there is distributed in nearby towns for lighting and street railway purposes.

Sixteen miles upstream from the Turners Falls dam, and four miles north of the Massachusetts and New Hampshire boundary line, is the mouth of the Ashnelot River on the Connecticut, and at this point the water elevation is thirty-three feet higher than the top of the dam. It is on this stretch of sixteen miles along the Connecticut, with its fall of thirty-three feet, that two hydroelectric plants are to be built for the purpose of power transmission to Massachusetts cities and towns.

One of these plants is now under construction with a dam that crosses the Connecticut between Vernon, Vt., and Hinsdale, N. H., the power house being on the Vermont side. The other plant, according to the charter of the French King Rapids Power Company, is to be constructed with a dam across the Connecticut between the town of Gill and the town of Northfield or of Ewing, in Massachusetts. It cannot be stated here what the available head of water will be at each of these plants, but as indicated above, the total fall along the sixteen miles of river from a point near the upper plant to the Turners Falls dam is thirty-three feet

Above the mouth of the Ashnelot River, the Connecticut drops only thirteen feet in a length of twenty-three miles, but the dam between Hinsdale and Vernon can probably be made high enough to get the advantage of a part of this fall above.

This hydroelectric plant at Vernon is being built by the Connecticut River Power Company, and it is understood that transmission lines now under construction to Fitchburg and other points in Worcester County, Massachusetts, are to deliver energy generated by this company. The dam and power house now under way at Vernon, Vt., are about forty miles from Fitchburg, fifty-five from Worcester and eighty miles from Bostom, in direct lines, but the lengths of transmission lines would be somewhat greater than these figures. In the other direction, North Adams is about thirty-two miles and Pittsfield fifty miles from the dam.

Passing up the Connecticut from the plant at Vernon, the first large drop in the river is that at Bellows Falls, where the water comes down forty-nine feet, at a point some thirty-eight miles north of the Massachusetts state line. Large manufacturing plants are located at Bellows Falls, and there is an electric plant for local lighting, but a large part of the river discharge does no useful work.

Along the four miles of the Connecticut from Ledyard Bridge, Hanover, N. H., to White River Junction, the water falls thirty-six feet, and here again local manufacturers are believed to absorb only a fraction of the available power. White River Junction is about seventy-four miles north of the Massachusetts state line, and so the power there, like that below at Bellows Falls, is within transmission distance of a number of cities in that commonwealth, from an engineering standpoint at least.

The next great series of falls, as one goes up the Connecticut, is located with its foot seven miles above Wells River, Vermont, and its head twenty-three miles further upstream. Along this twenty-three miles the river falls 398 feet, and its development for power might well include some of the engineering features that have been adopted at hydroelectric plants with high heads, in California.

Connecticut Lake, the lower one of the chain in which the river of that name has its source, has an elevation of 1,618 feet above sea level, and from that lake to West Stewartstown, N. H., a distance of seventeen miles, the fall of the river is 583 feet, or an average of thirty-four feet per mile.

The United States Geological Survey has two gauging stations on the Connecticut River, one at Sunderland, Mass., and the other at Oxford, N. H. At Sunderland the gauge is about eighteen miles above the Holyoke dam and five miles below the dam at Turners Falls, and was erected in March, 1904. Orford, the site of the other gauge, is twenty-one miles above White River Junction, and some ninety-four miles above the hydroelectric plant now under construction at Vernon, Vt. The Orford gauge was erected in August, 1900.

At the Holyoke dam, a record of the discharge of the Connecticut River was kept from 1880 to 1899, inclusive, and is published in Volume 58, Transactions American Society Civil Engineers, also, in part, by the United States Geological Survey. Estimates of the discharge of the river at Hartford, from 1871 to 1885, inclusive, were published in the Fourteenth Annual Report of the United States Geological Survey.

The following figures for the maximum and minimum discharge of the Connecticut at Orford and Sunderland are taken from annual reports of the Geological Survey:

DAILY DISCHARGE OF CONNECTICUT RIVER IN SECOND-FEET.

	At Orford, N. H.		At Sunderland, Mass.	
Year.	Maximum.	Minimum.	Maximum.	Minimum.
1902	29,165	2,108	.....	.....
1903	32,350	640	.....	.....
1904	20,310	620	69,050	2,310
1905	28,470	1,460	87,920	3,950
1906	26,300	950	72,300	1,630

At Orford, the records of 1905 are for eight months, and at Sunderland the records of 1904 and 1905 are for nine months, respectively, and the records of 1906 are for eight months.

The twenty-year records above mentioned, at Holyoke, show a maximum discharge for the entire period of 115,000 feet per second, in 1895, and a minimum of 1,600 feet per second, in 1894. In three of these years the minimum discharge was less than 2,000 feet per second, and in thirteen years the minimum was less than 3,000 feet per second.

The hydroelectric plant at Vernon, Vt., is at a point on the river where the discharge is greater than that at Orford and less than that at Sunderland. Without assuming to decide what rate of river discharge can be utilized with advantage at Vernon, it may be said that each 1,000 cubic feet of water per second passing the turbine wheels there, at a head thirty feet, that being the reported height of the dam, will develop 3,400 gross horsepower, and sixty per cent of this, or 2,040 electric horsepower, may be transmitted to consumers, under fair conditions.

Of the total fall of thirty-two feet from the top of Enfield dam to the foot of Enfield rapids, above Hartford, Conn., where it is proposed to erect a hydroelectric plant to generate energy for transmission to several cities, perhaps thirty feet can be made available at turbine wheels. With an effective head of thirty feet, and total losses of forty per cent, the electric power that may be transmitted to consumers, per 1,000 cubic feet of water utilized by the wheels, is 2,040 horsepower, as above.

A plant at Enfield will, however, have more water available than the Vernon plant, because the Millers, Deerfield, Westfield and Chicopee rivers discharge into the Connecticut between these two points.

With the large flow of the Connecticut River falling 102 feet from Hanover, N. H., to the top of the Turners Falls dam, in Massachusetts, a distance of ninety-three miles, and most of this fall and flow unused, there is evidently a great supply of waterpower within the reach of the industries of the Bay State, when conditions warrant its transmission.

Dr. Steinmetz Will Discuss Prime Movers.

The two-hundred-and-thirty-fourth meeting of the American Institute of Electrical Engineers will be held at 8 p. m., on February 19, in the Engineering Societies Building, 33 West Thirty-ninth Street, New York city. Dr. Charles P. Steinmetz will present a paper entitled "Prime Movers," in which he will consider the hydraulic turbine, the steam engine, the steam turbine, the gas engine with and without gas producer, and the gas turbine.

ALTERNATING CURRENTS AND THEIR APPLICATIONS.

BY EDSON R. WOLCOTT.

CHAPTER IV. (PART III.)—TRANSFORMERS.

AUTOTRANSFORMERS.

Balance coils or autotransformers are transformers with only one winding, but

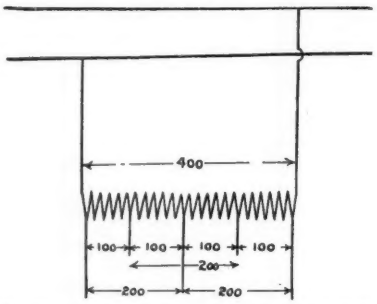


FIG. 96.—AUTOTRANSFORMER WITH VOLTAGE TAPS.

that winding is divided up and taps made at various points, as shown in Fig. 96.

The winding is connected to the mains as shown. External connections are then

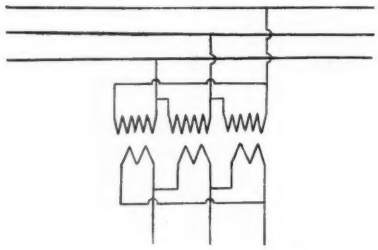


FIG. 99.—THREE-PHASE TRANSFORMER GROUP; PRIMARIES DELTA-CONNECTED, SECONDARIES DELTA-CONNECTED.

made at certain points; for instance the five points shown.

If the coil is uniformly wound and the connections are at equal distances, the potential differences between any two adjacent taps will be the same. Thus, if the total drop is 400 volts, the voltage across the terminals of each individual coil will be 100 volts, and across any two coils 200 volts, as indicated in the diagram.

Coils of this type, having three connections only, instead of five, are often used on two-wire circuits for providing two circuits with one wire in common, as is used in the three-wire system of lighting. In the illustration two circuits of 200 volts each could be obtained from the one circuit of 400 volts, as shown. Suppose the total voltage is made 200 volts instead of 400, the drop across each of the two circuits is then 100 volts. Let the same number of lamps be connected in each circuit, no current (other than the small exciting current) will then flow through the coil; but if there are fifty lights on one circuit and 100 on the other, the coil will then carry the load of the unbalanced fifty lights. Also, if there were 150 lights on one circuit and 100 lights on the other, the load would still be fifty lights. In all cases the load on the balance coil is equal to the difference in load in the two circuits, since only the unbalanced current is sup-

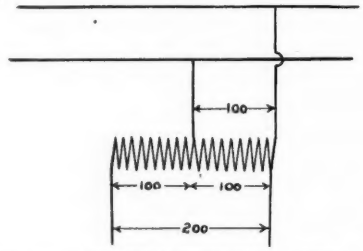


FIG. 97.—AUTOTRANSFORMER USED AS STEP-UP TRANSFORMER.

plied by the coil. The coil may therefore be used on a circuit with any number of lights, provided it has a capacity large enough to supply whatever unbalancing is likely to occur. It is customary to

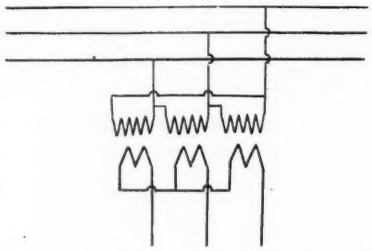


FIG. 100.—THREE-PHASE TRANSFORMER GROUP; PRIMARIES DELTA-CONNECTED, SECONDARIES Y-CONNECTED.

select a coil of such capacity as to supply one-half the total number of lights on the two circuits so that all the lights in one circuit might be turned on and all the others turned off. If the load con-

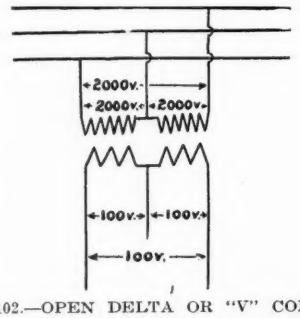


FIG. 102.—OPEN DELTA OR "V" CONNECTION OF TRANSFORMERS SUPPLYING THREE-PHASE CURRENT.

ditions were such that this extreme condition could not occur, a balance coil of correspondingly smaller capacity could be used.

EFFICIENCY OF BALANCE COILS.

Even assuming the first condition, the balance coil is cheaper in first cost, more efficient and simpler, and lighter in weight than a two-coil transformer designed for the same service.

USE AS STEP-UP TRANSFORMER.

It is also possible to use a balance coil to step up the voltage. The connections are then made as shown in Fig. 97. A tap at the middle point of the coil and one end are connected to the mains, the

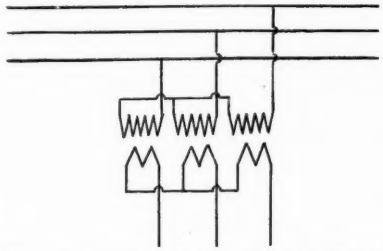


FIG. 98.—THREE-PHASE TRANSFORMER GROUP; PRIMARIES Y-CONNECTED, SECONDARIES Y-CONNECTED.

consuming circuit being connected to the extreme terminals, as shown. In this way a 200-volt circuit is obtained from a 100-volt circuit. Higher voltages can be obtained by connecting the mains over

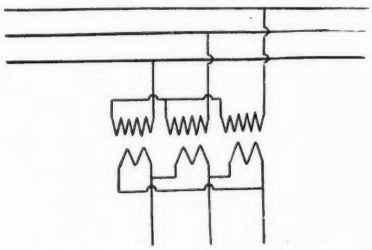


FIG. 101.—THREE-PHASE TRANSFORMER GROUP; PRIMARIES Y-CONNECTED, SECONDARIES DELTA-CONNECTED.

a smaller number of turns of the balance coil.

POLYPHASE TRANSFORMERS.

In general polyphase transformation is accomplished by individual transformers in each phase. In this way each phase is transformed like a separate circuit. In a three-phase, three-wire system the transformers may be delta or Y-connected to the mains. However, it is not necessary that the secondary terminals of the transformers be connected to the consuming circuit in the same manner in which the primary terminals are connected to the supply mains. Consequently four different arrangements are possible, viz., the Y-Y connection, the delta-delta connection, the delta-Y connection and the Y-delta connection.

The Y-Y connection and the delta-delta connection are illustrated in Figs.

98 and 99. An easy way to distinguish the one from the other is to recall that in the former the three coils are connected to a common point and in the latter they are all connected in series. It is evident that the connection of the secondaries of the transformers just mentioned could be interchanged, in which case the delta-Y and the Y-delta connections would be illustrated, as shown in Figs. 100 and 101.

DELTA-DELTA CONNECTION.

The preferable arrangement is that obtained by the use of the delta-delta connection, because the system is then operative should one transformer give out. To be sure, the load on the other two would then be considerably increased, but if they are capable of standing the overload the system will continue to operate.

THE V-CONNECTION.

As just stated, it is possible to operate a three-phase system of transformation

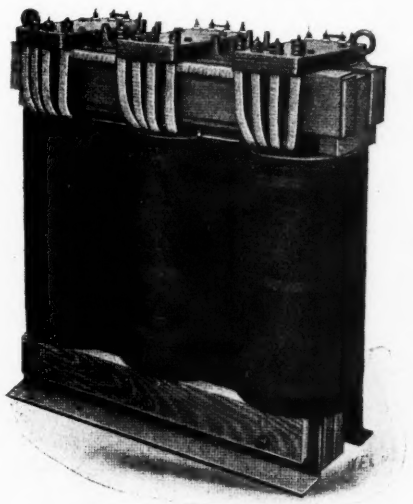


FIG. 103.—THREE-PHASE TRANSFORMER WITH SINGLE MAGNETIC STRUCTURE.

by means of only two transformers which are connected in any two of the three phases of a three-wire, three-phase system, as shown in Fig. 102. With 2,000 volts potential difference between each of the three supply mains and only two transformers connected, as shown, the voltage between any two of the secondary terminals will be 100 volts if the ratio of transformation is twenty to one. This is sometimes known as the V method of connection.

With two-phase four-wire circuits a transformer is connected in each of the two phases. By using either circuit alone a single-phase current is, of course, obtained.

CONSTRUCTION OF POLYPHASE TRANSFORMERS.

It is possible to combine the magnetic circuits of polyphase transformers by winding all of the coils on the same or connected magnetic circuit. Thus one set of transformer coils can be wound on one leg, another set on another leg, and the third set on the third leg, as illustrated in Fig. 103. In this way the three transformers of a three-phase system are built on the same magnetic circuit. Since the currents in the three

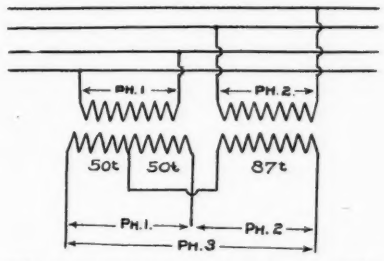


FIG. 104.—TRANSFORMATION OF TWO-PHASE INTO THREE-PHASE CURRENT.

primary coils are 120 degrees out of phase with each other, the magnetic flux coming from any leg is 120 degrees out of phase with that coming from either of the other two legs, and each core of the three sets of coils may be considered the return path for the magnetic flux of the other two, as was graphically shown for currents in three-phase transmission in Fig. 28.

CHANGE OF PHASE.

Transformations from two-phase to three-phase current and from three-phase to two-phase can be made by means of transformers with taps, as shown in Figs.

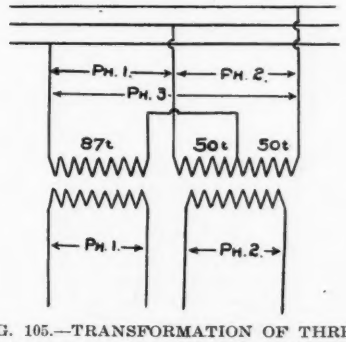


FIG. 105.—TRANSFORMATION OF THREE-PHASE INTO TWO-PHASE CURRENT.

104 and 105, which illustrate methods of transforming from two-phase with four wires to three-phase with three wires, or vice versa.

This is accomplished by the use of special transformers having coils of a number of turns, t, proportional to the ratio indicated in the diagrams.

Automatic Brake for Runaway Cars.

An electromagnetic street-car brake, the invention of A. W. Maley, has been subjected to a series of important trials by the corporation of Birmingham, England, and it is generally believed that the problem of braking a runaway car on dangerous gradients has been solved. The contrivance adds about half a ton to the weight of the car, and is a combination of the principle of mechanical and electromagnetic brakes, being applied both to the track and to the car.

No braking is done on the wheels other than to drive the motors as generators, when descending a hill or making a stop. The current so generated is utilized for the track magnets, which in turn are attracted to the rail, and by their backward movement as the car goes forward, throw into action mechanical rail shoes. In addition to its electromagnetic function, the brake may be applied by hand from the driving platform. The magnets are excited either by the current taken from the motors acting as generators, or, by the operation of a special canopy switch, they may be energized directly from the trolley.

The trials in Birmingham have been regarded as satisfactory. The most severe test to which the invention was subjected was in attempting to stop a runaway car. The car was brought down a gradient at a speed of about twenty-seven miles an hour, and half-way down the hill the brake, operated in conjunction with the motors, was applied. Rain had previously fallen, making the track greasy, yet, unaided by the application of sand to the rails, the heavy car was successfully brought to a standstill within eighty yards from the spot at which the driver commenced to apply the brake.

American Society of Mechanical Engineers.

The next monthly meeting of the American Society of Mechanical Engineers will be held February 23. The subject of the evening's discussion will be "Safety Valves," introduced by a brief paper by Frederic M. Whyte, general mechanical engineer of the New York Central lines. Mr. Whyte will discuss the principles of the application of safety valves to steam boilers, with special reference to locomotive practice, including questions of design and construction and the requirements and limitations of valves. His paper will be followed by a general discussion covering marine and stationary practice and conditions existing in connection with low-pressure heating boilers.

Operating Results from a Sixty-Cycle Gas-Driven Power Station.

BY J. R. BIBBINS.

There has been so much speculation within recent years on the possibility of success in operating gas-driven sixty-cycle alternating-current generators in parallel on a fluctuating industrial load that some actual experience and results from a modern plant would seem to be of value and interest at this time. The reasons for selecting the Swissvale plant of the Union Switch and Signal Company are noted below. All of these characteristics are rarely found in a single plant:

1. This station was one of the very earliest sixty-cycle plants installed in this country, yielding eight years' experience to date.

2. Its operation at all times has been representative of the average industrial plant on twenty-four-hour service.

3. Its growth has been along lines identified with good engineering.

To the author's best knowledge, parallel operation by gas engines on a commercial scale, was first wrought out in America in the Pittsburg district. As early as 1900 to 1902, the following three plants were equipped with engines ranging from 125 to 300 horsepower in the vertical single-acting type: The Westinghouse Machine Company, East Pittsburg, Pa., 900 horsepower; R. D. Nuttall Company, Pittsburg, 500 horsepower (equipment later doubled), and the Union Switch and Signal Company, 500 horsepower (equipment later doubled).

The fact that all of these machines are today in regular service, is the best evidence that the preliminary experiments of 1899 at East Pittsburg were successful. These experiments were conducted on engines of the vertical, single-acting type in the effort to solve parallel operation. After various attempts at solid coupling, the result was a recommendation of flexible drive for sixty-cycle work, and all plants were so equipped. Generator spiders were mounted on loose sleeves with helical-spring couplings. One unit in each plant, however, was solid coupled; for operating alone, the cyclic variation was quite negligible.

The old Swissvale plant was in continuous service night and day up to 1908, when, by reason of extensions to the manufacturing plant at Swissvale, an enlargement of the power plant became necessary. The original equipment was transferred to a new generating station, designed primarily for the horizontal-type double-acting engine, and illustrated in Fig. 1. This new power station[1] went into service May 11, 1908, and operates along precisely the same lines as the old. In fact, both single-acting and double-acting units are in daily service in parallel on the same load.

The normal shop load at Swissvale extends through twenty-four hours with sustained morning and afternoon output, and an all-night load fifty per cent lower, yielding an average loading factor for the entire plant of about forty per cent of its capacity. While the hourly output is fairly uniform, instantaneous fluctuations are incessant, due to the application of large motors, probably averaging twenty-five per cent above and below mean. There is also a twenty-four-hour lighting load often carried from the power bus. Although voltage regulators are employed, the fact remains that any such apparatus, however sensitive, would be quite incapable of compensating for inherent irregularities in turning moment at the shaft. The service at this plant is such as to impose a most satisfactory test of sixty-cycle parallel operation. Incidentally, it may be noted that some of the units have a record of seven weeks' continuous operation.

The character of attendance at Swissvale is normally a chief, trained in gas-engine work, and assistants educated at the plant. In the old plant, two men operated 1,000 horsepower in gas engines, together with air-compressors. At present, during the day three men have charge of double that capacity, while two are on the night shift.

The operations of starting, synchronizing, distributing load, etc., are practically identical with steam practice. At the board a synchronizer and the usual lamps determine the time of switching. Any of the operators is capable of paralleling with the assistance of a second man to depress the governor by hand while adjusting speed. A separate adjustment of the governor springs provides for equalizing load. Starting is automatically accomplished by compressed air, one valve controlling all four inlets to individual combustion chambers. Usually fifty to sixty pounds pressure is sufficient for the purpose, although high-pressure tanks are kept continually charged. Normal ignition usually commences on the third revolution. A centrifugal safety-stop at the flywheel rim prevents overspeed by trip-

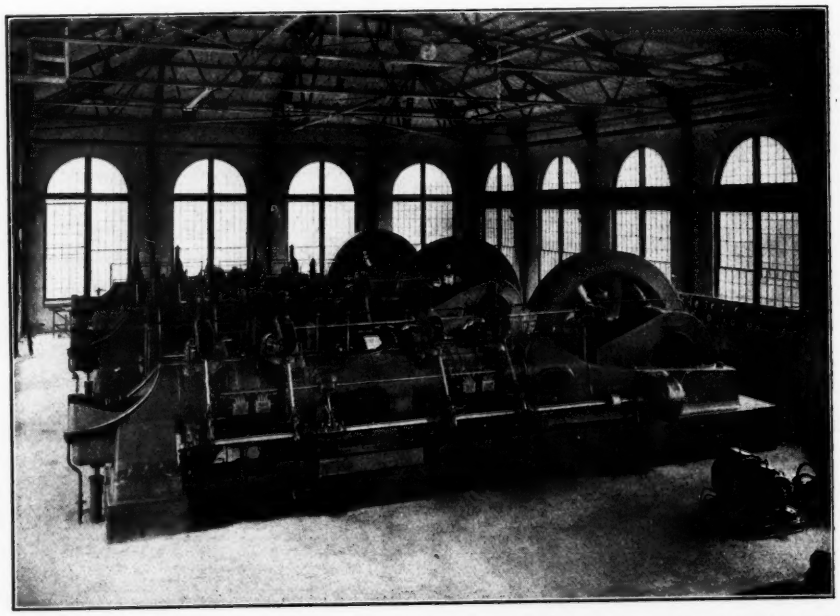


FIG. 1.—INTERIOR OF THE 2,000-HORSEPOWER GAS-DRIVEN POWER STATION OF THE UNION SWITCH AND SIGNAL COMPANY, SWISSVALE, PA.

1. A brief detailed description of this new power plant, which has already been described elsewhere, will be found at the close of Mr. Bibbins' article.

ping a switch which opens the ignition circuit. Both cylinder and journal lubrication is automatic, which is also the case with the single-acting enclosed-type engine using splash lubrication. The oil supplied to each engine and the cooling water to the jackets are each controlled by single valves, so that in starting an engine there are but five operations: 1, igniter switch; 2, compressed air; 3, gas throttle; 4, water gate; 5, oil valve. These present no complexity, even in emergencies, and, in fact, the engine is favored in comparison with steam-driven condensing units.

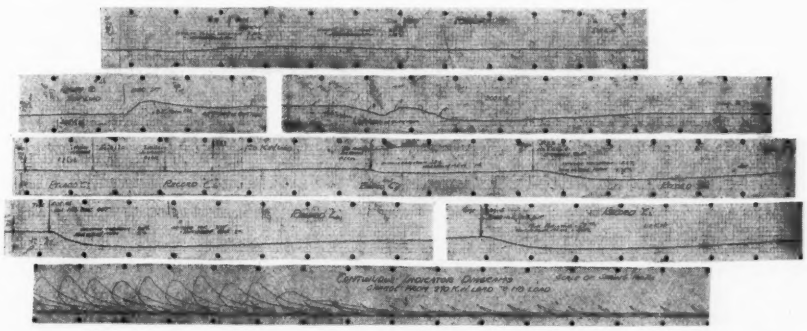


FIG. 2.—REGULATION CURVES AND INDICATOR DIAGRAMS FROM SWISSVALE GAS-ENGINE PLANT.

Automatic lubrication was brought about by the absolute necessity of avoiding carelessness of operators. Owing to the extreme temperatures and lack of presence of moisture, as in steam cylinders, ample lubrication is imperative. And although double-acting pistons are supported free from the cylinder walls by front, centre and rear crossheads, a stoppage of lubricant for any length of time would likely result in scoring cylinders. The mechanical sight-feed system, driven by the engine itself, avoids this danger, and incidentally largely reduces the quantity used, by injecting cylinder oil only on the induction stroke, when it is easily spread over the cylinder surface before combustion takes place. Similarly, the continuous gravity filtration systems for engine oil have practically eliminated troubles with hot bearings and have reduced the consumption of lubricating oil practically to the point of leakage, evaporation and waste.

Ignition, a second vital point in gas-engine operation, is rendered reliable by the use of two or more igniters in each combustion chamber, all fired at the same instant but separately fused so that a troublesome igniter can be isolated. Incidentally, it is a matter of good fortune that the more perfect combustion produced by igniting the gases at different points, results in a three to four per cent increase in power, as shown by tests with one and two igniters, respectively. The effectiveness of this system may be measured by the results produced. In Fig. 2, F shows some representative cards taken during a change from full load to no load.

FIG. 3.—TYPICAL CONTINUOUS INDICATOR-CARD RECORD FROM 3,000-HORSE-POWER BLAST-FURNACE GAS ENGINE FROM FULL TO NO LOAD.

The ignition is quite uniform. A remarkable record of blast-furnace-gas operation, Fig. 3, to be discussed later, also shows this feature.

It is the policy at Swissvale to spend enough annually for repairs to maintain the equipment at its original state of efficiency, or in other words, to forestall depreciation, except in the form of obsolescence. The maintenance account, therefore, includes items which might have been avoided had it been the intention to put the plant out of commission after a comparatively short period of service. Considering the original equipment of vertical gas engines, this maintenance account of the sixth and seventh years of service averaged about four per cent of the plant valuation—equivalent to twenty-five years' life—by no means an abnormal rate of depreciation.

The following notes indicate the normal repair work necessary: The vertical cylinders have not yet required reboring, and the exhaust valves require regrinding only once in six months. The igniter points on the small engines are examined and repaired twice each month. This is due to replacing platinum by iron-wire points, which, of course, wear down at a much faster rate. With the old platinum points engines have run seven weeks continuously without shutting down for replacing igniters. In the horizontals no points are used, and the igniter terminals, lasting several years, require facing not more than once in three months. The jackets require cleaning about once a year. The vertical-engine bearings are taken out once a year; those of the horizontal engines only as occasion demands. The horizontal piston-rod packings or piston rings have not yet been removed, having been in operation only eight months. In general, there is no indication that alternating-current parallel operation is in the least responsible for any greater share of the repair items than in the operation of direct-current generators.

TABLE I.—COST OF POWER AT SWISSVALE PLANT.

Capacity of plant..900 horsepower, 500 kilowatts	
Number of units	5
Type of units.....Vertical, single-acting, spring-coupled	
Maximum loading factor, January, February and March	44%
Gas per kilowatt-hour (according to quality)	22-25 cu. ft.
Approximate cost of plant....$100 per kilowatt	
Average cost of operation for 50% loading factor, output 2,190,000 kilowatt-hours per year:	
Fuel, at 15c. per 1,000 cubic feet	$ 5,150
Water (estimated, 10% make-up)	300
Oil and waste	1,000
Labor (3 men day, 2 men night)	4,200
Repairs and maintenance (4% plant valuation)	2,000
Total operating cost—0.58c. per kilowatt-hour	$12,650
Fixed charges:	
Interest, 5%; taxes, 1%	3,000
Insurance (building fireproof)	
	$15,650
Total cost of power per kilowatt-hour	$.0071

Owing to the difficulty of segregating some cost items from blanket accounts, we cannot obtain from the records of the old Swissvale plant a schedule of power costs exactly comparable to central-station practice. However, a fairly accurate analysis may be made from the records as presented in Table I. These data correspond to an average station loading factor of

sixty per cent, with fuel at fifteen cents per 1,000 cubic feet, and other items of cost pro-rated from the present schedule. A fixed charge of ten per cent for maintenance, interest, etc., has been included. On this basis the old 1,000-horsepower plant was able to deliver power at the switchboard for 0.58 cent operating, and 0.71 cent per kilowatt-hour total. These figures clearly define the question of commercial cost as well as thermal efficiency, and are verified by the actual records, which have been kindly furnished by J. G. Schreuder, second vice-president and consulting engineer for the company. No records under comparative conditions have yet been obtained from the new horizontal plant, as it is at present very lightly loaded and has not been in operation a sufficient length of time to yield a fair average.

Present interest in the Swissvale plant centres largely in its ability to give suitable regulation for sixty-cycle work. Some results in this line will, therefore, be of interest. The problem of gas-engine governing involves several factors: a, Simple speed regulation with varying load; b, cyclic speed variation resulting from variable crank effort; c, governor lag behind admission; d, possibility of missed power stroke from back-fire or igniters. Contrasting the steam turbine, steam engine and gas engine, we find very dissimilar conditions. In the turbine, the governor and the resultant dynamic effort change simultaneously; *i. e.*, there is no time lag. In the steam engine, the governor acts in the same stroke as the previous cut-off; *i. e.*, assumes a position determined by previous admission, less than ninety degrees lag. In the simple four-cycle engine, the governor lags two strokes behind the admission, but with the tandem cylinder arrangement, this lag is reduced to one stroke. Fortunately, with the flywheel weights necessary to absorb cyclic variation, this lag is comparatively unimportant and may be observed only in the over-travel of the governor during extreme load changes, as later shown.

In view of this unavoidable lag, governors tending to anticipate speed change, such as those of the isochronous or the inertia types, are evidently least suited as introducing needless sensitiveness, or instability. On the other hand, the simple centrifugal type carefully designed for the work in view, has proven quite suitable, especially those types in which the centrifugal force of the weights is resisted by direct spring tension without intervening levers or contacts (such as the Hartung, Jahns, etc.).

In most large gas engines the relay system of governing is employed. Two important elements enter into this relay system: First, the regulator is entirely relieved of the work of moving heavy valves, which is particularly necessary when they are fouled by tar, dust or other foreign matter. Thus the effect of valve friction

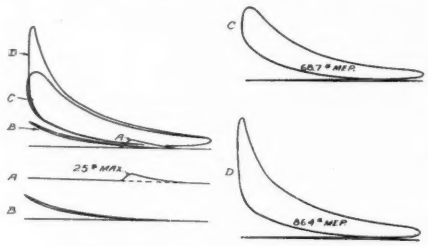


FIG. 4.—SEQUENCE OF INDICATOR CARDS, SHOWING SMALL EFFECT OF A BACK-FIRE.

is entirely eliminated. Second, control of the motive fluid is possible right at the point of entry to the cylinder. In the early designs of multi-cylinder engines, a single governor valve was employed to

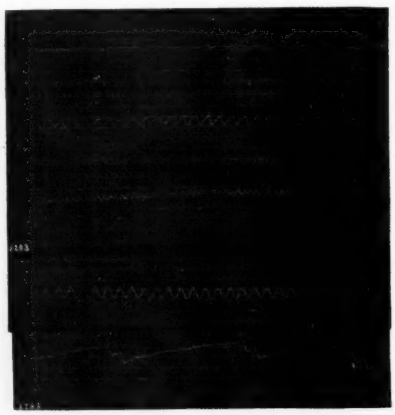


FIG. 5.—TACHOGRAPH RECORD OF COTTON-MILL GAS ENGINE.

Records show cyclical speed variation and average speed change of double-crank, two-cylinder, twenty by thirty-inch, 600-horsepower gas engine running at 155 revolutions per minute. The vertical division lines denote revolutions.

1. Engine on full load; normal mill service; governing by throttling mixture admitted to cylinder; degree of irregularity, 1/500.
2. One end of one cylinder cut out by stopping ignition; all cylinders taking mixture and compressing as usual; three-quarters load approximately; irregularity, 1/110.
3. Opposite end of each cylinder cut out; all cylinders taking mixture and compressing as usual; approximately one-third load; irregularity, 1/100.
4. One cylinder only working; other cylinders taking mixture and compressing as usual; approximately one-third load; irregularity, 1/100.
5. Effect of missed ignitions on one end of one cylinder; two and three missed ignitions were made.

Full load (340 kilowatts) to no load—12.8 per cent momentary, 2.4 per cent steady, 1.2 per cent above and below mean.

control all cylinders, resulting in a large quantity of mixture lying idle between valve and outlying cylinders. Before any further governing could be accomplished this idle mixture evidently had to pass through the cycle, the time element involved varying with the distance of the cylinders from the governing valve; and, most important, a single back-fire would vitiate the incoming mixture for all cylinders. The present system of governing at inlets only, is evidently the direct reverse, embodying the very important point that there is practically no idle mixture between governor valve and inlet; *i. e.*, that the supply at each stroke is exactly equal to the demand—this minimizing the effect of back-fires, as shown elsewhere.

There has been much discussion upon the merits of the constant versus variable-quality system of gas-engine regulation. The one governs by throttling a mixture of most effective proportions; the other, by introducing more or less excess air, according to the load, to fill the cylinder and maintain constant compression. Quite recently a statement was publicly made which questions the merits of the constant-quality system for conditions of lean gas and light loads. Here is involved the crux of the whole problem of regulation, viz., absolute uniformity of combustion under all conditions. Evidently parallel operation would be a failure if uniform combustion could not be guaranteed.

Without further comment, it is believed that the continuous indicator record shown in Fig. 3 will contribute most satisfactory evidence on this point. This record was obtained at the Carnegie Steel Works on a 2,500-horsepower four-cycle tandem double-acting blowing engine. It covers a complete cycle of blast-furnace operation from full load to no load and vice versa. This record, forty feet in length, comprises 396 cards without the least evidence of misfires, back-fires or incomplete combustion, either at full, half or no load. To the author's mind, this record refutes in the most convincing manner the criticisms alluded to. Similar results were obtained at Swissvale on natural gas, as shown in Fig. 2. Incidentally, both records exhibit the uniform firing of the multiple-ignition system employed.

Another exaggerated gas-engine trouble is the effect of back-fires on the uniformity of power and crank effort. Fig. 4 shows a sequence of cards following a back-fire, which illustrates the point at issue in a most fortunate manner. In card A the mixture fired on induction stroke from some unascertained cause, and the corresponding power stroke was missed. But on the succeeding power stroke a card above normal mean effective pressure was obtained, followed by one of maximum mean effective pressure. The net result was one missed stroke and a slight over-reaching of the governor. This same effect

would be produced by a misfire, but, as will be shown later, a single back-fire or misfire is hardly discernible in engine operation. If continued, the defective cylinder end would, of course, have to be isolated and the load reduced accordingly. But this is an extremely rare occurrence and concerns the engine designer, not the operator. Conservative engineering dictates a liberal factor of safety in alternating-current gas-engine work, over the limits of angular deviation specified by the electrical companies for safe practice—a factor of safety sufficient to cover ordinary contingencies, such as maladjustments, misfires, or back-fires. Conversely, it is a fortunate fact that in normal running, the angular variation is relatively low, and hence, all the better suited to parallel operation.

These points are clearly illustrated in some tachograph records, Fig. 5, showing angular variation, taken by H. A. Humphrey, a prominent British engineer, from a Westinghouse double-crank two-cylinder, twenty-four by thirty-inch double-acting engine, running at 155 revolutions per minute, with cranks at 180 degrees. This is equivalent in arrangement to the cross-compound steam engine, and, in sequence of power impulses, to the single-crank, double-acting tandem gas engine discussed. The subjoined legend is self-explanatory. We may note, however, the following facts: First, Two power strokes followed by two misfires result in twice the frequency of variation of one power followed by one missed stroke, both increasing the degree of irregularity about four times. The former corresponds to one cylinder out, the latter to the forward end of each cylinder, or both rear ends. Second, the two missed ignitions result in four times greater irregularity. These changes correspond precisely to the experiments noted below from the Swissvale engine.

As a comparative curiosity, Fig. 6 has been reproduced from a tachograph record taken on a tandem steam engine, fifteen and thirty by forty-two inches, running at fifty-two revolutions per minute, driving a cotton mill. So much has been said about the close regulation necessary in cotton-mill work, that this record is of extreme interest. The instrument shows over 4.6 per cent variation above and below the mean, or ten per cent irregularity, partly due, of course, to the low speed. This, however, is reduced to two per cent above and below the mean, or four per cent by transmission through a two-gear, one-rope and one-belt drive. This may be compared directly with record 1, Fig. 5, which was taken by the same observer on the same instrument in the same mill and driving the same machinery. It is exhibited not so much as representative of steam drive, but as illustrative of the wide discrepancy between conjecture and practice. All of the above records were obtained from a Horn recording tachograph with calibrated springs.

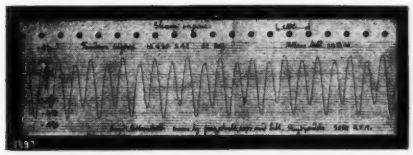


FIG. 6.—TACHOGRAM FROM TANDEM STEAM ENGINE FOR COTTON-MILL DRIVE.

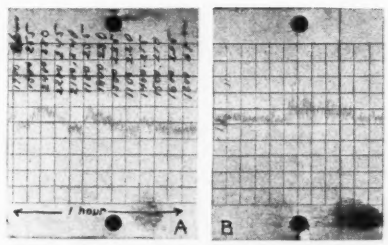


FIG. 7.—TYPICAL SPEED REGULATION OF TANDEM HEAVY-DUTY CROSS-COMPOUND CORLISS ENGINE.

As a sample of good Corliss practice in simple speed regulation, Fig. 7 shows tachometer records of two different makes of vertical cross-compound Corliss units operating on a widely variable steel-foundry load at Bessemer. Engine A was originally designed for twenty-five-cycle parallel operation, and was so operated in the service plant at the St. Louis Exposition. Both show a speed variation of 2.8 per cent above and below the mean speed.

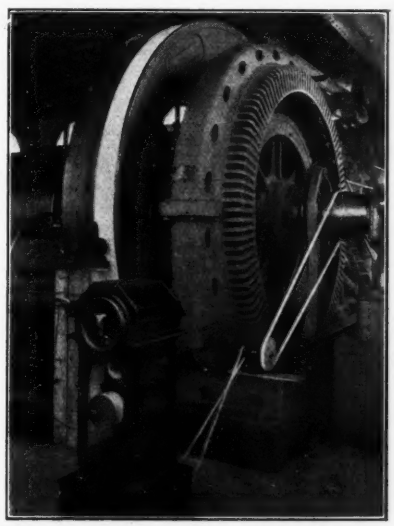


FIG. 8.—METHOD OF OBTAINING SPEED AND ANGULAR VARIATION RECORDS AT SWISSVALE.

Speed and deviation records have recently been made at Swissvale from the three horizontal engines installed, without any attempt to adjust the valve mechanism of the engine, and represent actual operation as experienced during the last six months. Fig. 8 shows the apparatus employed, a Moscrop recorder for speed variation and a constant-speed magneto motor for obtaining records of angular deviation on the face of the flywheel. Unfortunately, a Horn tachograph was unavailable for these experiments. This instrument is designed so that the natural period of vibration of the moving mass so far exceeds that of the cyclic-speed change, due to the strength of the resisting springs, as to enable it to record faithfully cyclic variations. On the other hand, the Moscrop records only speed change, having a natural period several times that of the quantity to be measured. Speed regulation is shown in Fig. 2, where each line is explained by the legend beneath. On regular shop load, the regulation is all that could be desired. On instantaneous change (no load to full load, and vice versa) the governor overtravels considerably, which is a characteristic of all governing systems having an unavoidable lag. The net speed variation, however, after subsidence of the surge, is normal, averaging 2.6 per cent; momentary, 5.6 per cent above or below mean. These machines were guaranteed at about this figure, three per cent above or below (six per cent total), the regulation being lowered in conformity to the demands of parallel operation, as in steam-engine and turbine practice.

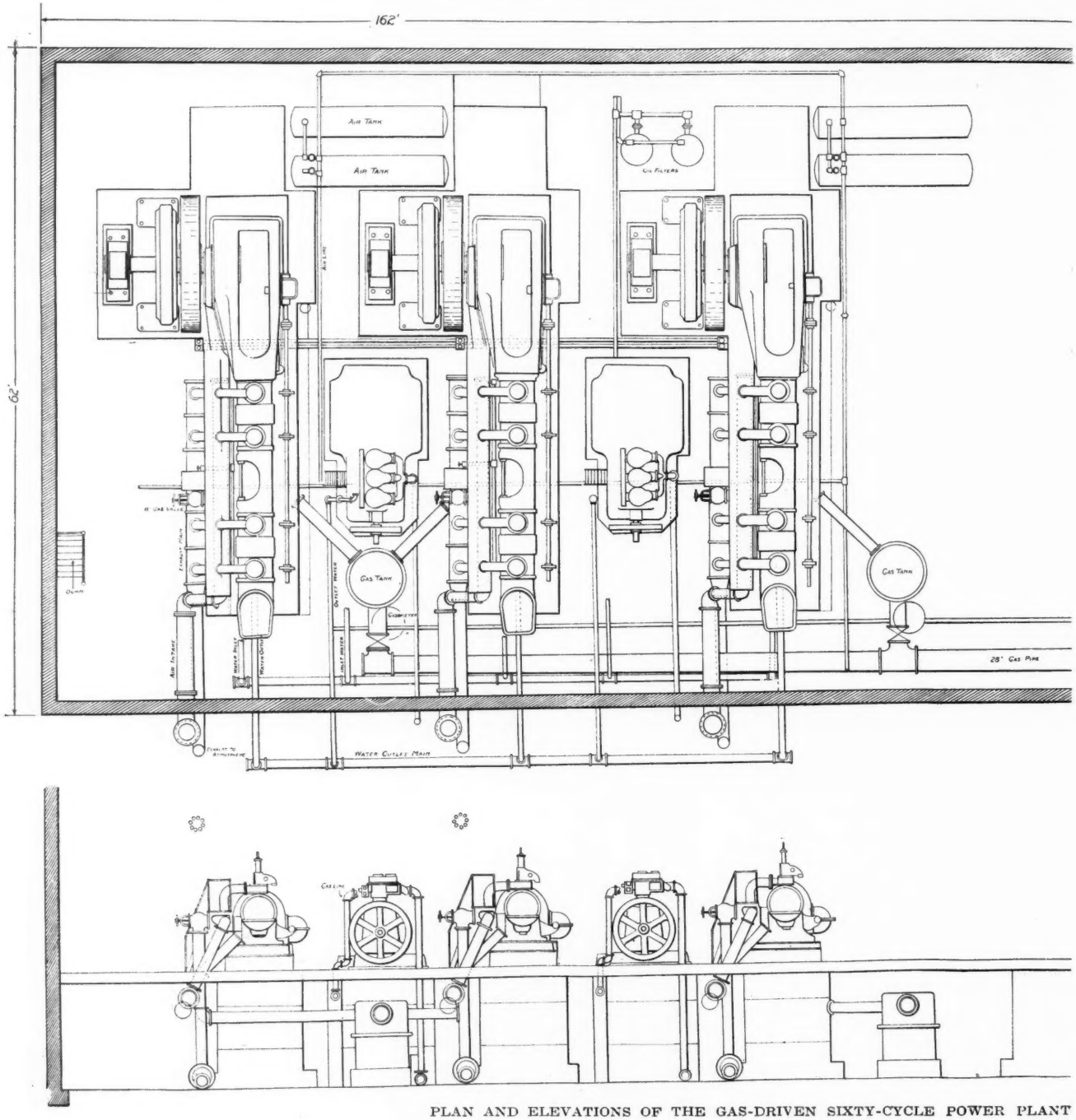
Note from record C, in Fig. 2, that the engine is practically unaffected by one or two missed ignitions. With one end cut out it drops momentarily 4.75 per cent below mean speed, but recovers in about one minute.

Up to this point, no fluctuation was visible at the switchboard wattmeters. With an entire cylinder out, some cyclical fluctuation was noticeable with an average momentary speed change of 6.25 per cent, and final two per cent below mean. Record B_b, Fig. 2, shows the effect of paralleling at the instant of shifting load; first the rise in speed at 3, due to the subdivision of load, then the fall 4 as the entire load was thrown on the new engine. No troublesome surging of speed takes place in the normal operation of the plant, and with ordinary care, the ma-

chines may be put together without noticeable fluctuation at the meters.

The flywheel records taken by the instrument, illustrated in Fig. 8, indicate a variation of about two electrical degrees during the revolution, at a load corresponding to about seventy-five per cent of the engine rating. Although about one-third the deviation permitted by generator builders, it is higher than normal, which may be explained by the fact that the valve mechanism had never been accurately adjusted by indicator. Recent cards taken simultaneously, show the cylinders to be considerably unbalanced; *i. e.*, the work is distributed unevenly. This condition may, of course, be entirely remedied by proper adjustment of governor reach-rods and ignition, as was later done. In one engine the disparity between the mean effective pressure of various cylinder ends, was found to be excessive, one end doing fully twice the work of the other, without resulting trouble in paralleling. The fact that these conditions existed without prejudicial effect on the general operation of the plant, is the best evidence of the great desirability of conservatism in design above noted. This disparity in loading of cylinders from maladjustment is, of course, encountered in a like degree in steam practice, and with the same results—impairment of regulation.

From the preceding discussion, it will be apparent that the underlying theme of this paper is the question of "results"—"What constitutes modern practice?"—"How closely have we attained to commercial conditions of operation?" The following facts would seem to have been established:



PLAN AND ELEVATIONS OF THE GAS-DRIVEN SIXTY-CYCLE POWER PLANT

1. The modern gas engine, properly operated, is quite equal to industrial power service, even with alternating-current distribution.

2. Eight years' experience points to a normal depreciation rate on the vertical type, with every indication of an equally satisfactory future for the horizontal-type engine.

3. The operation of either the horizontal or the vertical type presents no greater difficulties than good steam practice, and requires about the same extent and grade of attendance.

4. Ample security is provided in double-acting designs against careless operation, by automatic oiling and duplicate igniters.

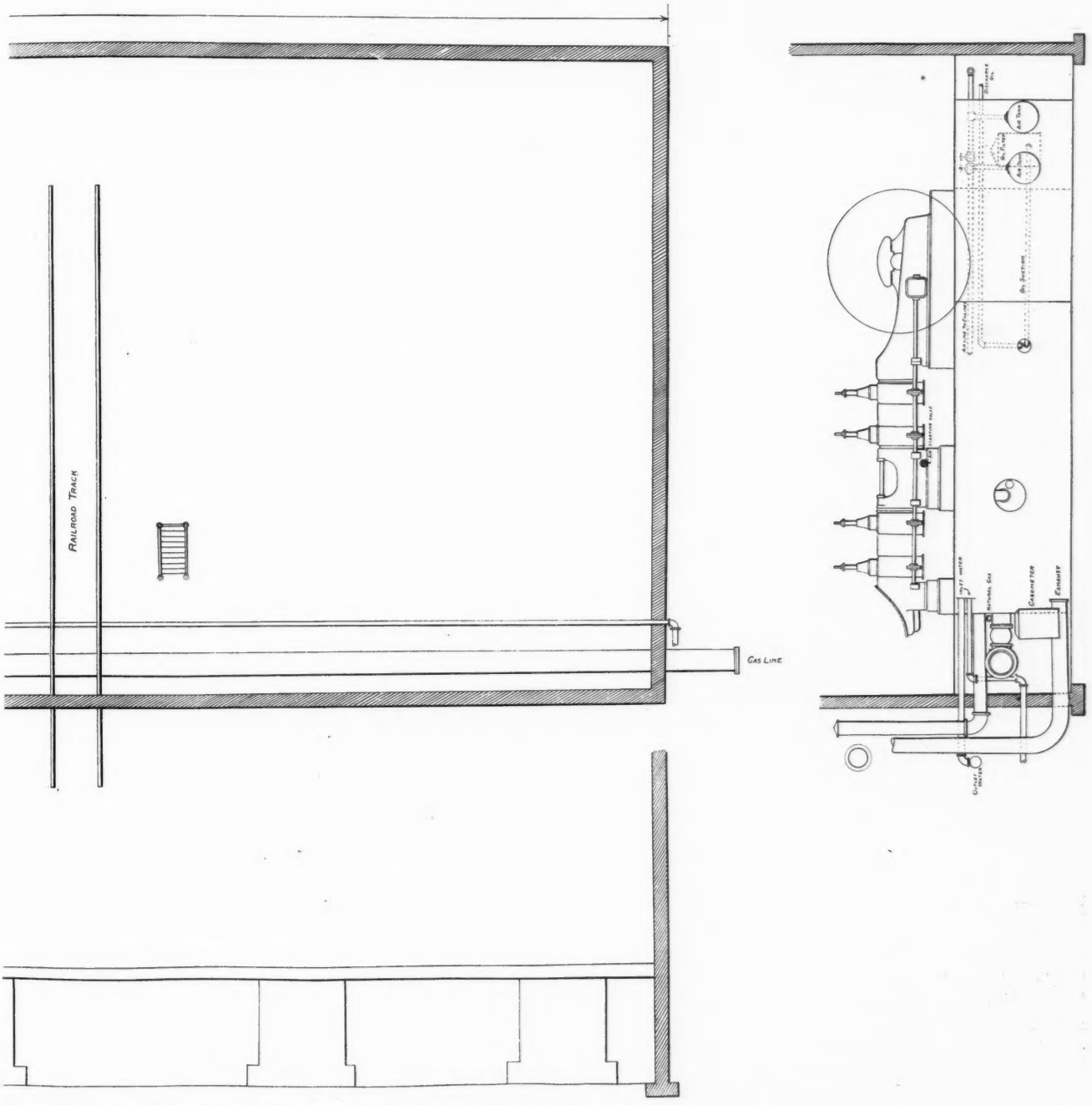
5. Necessary uniformity of combustion is assured.

6. Cost of power generation, with all charges included, is relatively low; well below steam.

7. Governing is suited to the demands of direct-current or alternating-current parallel operation, and speed variation is within present requirements. Angular deviation is well below steam practice, with sufficient factor of safety to cover ordinary contingencies.

Success, therefore, of solid-coupled, sixty-cycle plants is practically assured for general commercial service.

The power equipment of the plant of the Union Switch and Signal Company, Swissvale, Pa., consists of three 340-kilowatt alternators driven by Westinghouse horizontal, tandem, double-acting gas engines, and two ninety-kilowatt alternators driven by Westinghouse three-cylinder vertical-type gas engines. In the build-



OF THE UNION SWITCH AND SIGNAL COMPANY AT SWISSVALE, PA.

ing, space has been left for three additional large units. Gas is supplied to the engines through "steadying" gas-tanks and gasometers, which maintain a practically equal pressure on the supply mains. The small vertical-engine units, which, as shown in the accompanying plan, are located between the large horizontal units, are of the three-cylinder type, having a bore of thirteen inches, and fourteen inches stroke. Through flexible couplings they drive the ninety-kilowatt two-phase alternators at 260 revolutions per minute. These generators supply

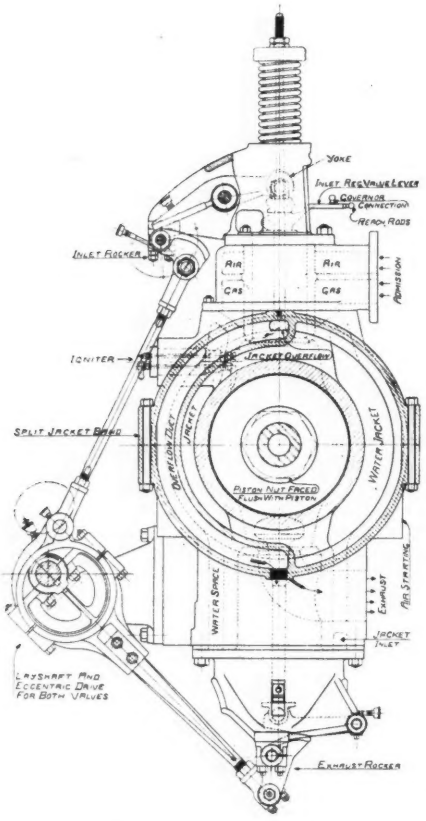


FIG. 9.—SPECIAL VALVE USED DURING NATURAL-GAS OPERATION AT SWISSVALE.

sixty-cycle current at 220 volts. The large horizontal engines are twenty-three-and-one-half inches in bore, with a stroke of thirty-three inches. The 340-kilowatt, two-phase, 220-volt, sixty-cycle, revolving-field alternators are driven at a speed of 150 revolutions per minute.

The present power-house equipment is supplied with natural gas, although in the future a battery of producers will be installed to furnish fuel for the engines. Special mixing-valves have been used in the admission ports to dilute the rich fuel gas now employed, since the design of the engines contemplated the use of the leaner producer product. Cooling water from the jackets is discharged into a series of ponds, during the passage of which it falls from forty to fifty degrees in temperature. From the pools it is pumped to a tank forty feet above the level of the engines, and is redistributed to the jackets by gravity. Both electrodes of the igniters, which are of the make-and-break type, are insulated. An easy-moving relay in each igniter circuit indicates the proper operation of the electrical circuit when the contact closes. These tell-tales are assembled over the middle pedestal of each engine, so that they are under the observation of the station operator. The two exciter sets for the large generator, one of seventy-five kilowatts and one of twenty-five kilowatts capacity, are driven by induction motors of 125 and forty horsepower, respectively. The exciters for the small ninety-kilowatt alternators are driven by belts from the generator shaft.

Telephone Legislation in Texas.

A bill of importance to the telephone interests of Texas has been introduced in the state Legislature by Senators H. B. Terrell, of West, and McDonald Meachum, of Navasota, which, its authors claim, is in the interest of the small independent telephone companies of the state. The measure declares telegraph and telephone lines to be common carriers, and places them under the jurisdiction and regulation of the railroad commission, with power to regulate all charges and fix local and long-distance rates, messenger service and tolls, and to stop abuses.

It requires physical connections of lines, wires, etc., whether local or long-distance, under the supervision of the commission, and the latter is authorized to regulate telephone exchanges and telegraph stations. The railroad commission is empowered to require a sufficient number of instruments, wires, etc., to give adequate service to the public and to make rates for lines and parts of lines. By this provision lower rates would be authorized between larger places where there is much business, while the rates to remote places with a limited amount of business would take higher rates. The commission can make temporary rates to meet emergencies just as it does with railroad rates. It is also empowered to apportion the cost of construction and operating joint exchanges, wires, connections, etc., as it does with railroads.

The companies are required to keep books and to furnish all data, records, papers and books when called upon to do so by the commission. Penalties are prescribed for violations of the provisions of the bill.

The subcommittee from the House Committee on Private Corporations has prepared a substitute for the telephone connection bill by Senators Terrell and Meachum. Instead of placing the telephone companies under the Railroad Commission this bill empowers the commissioners' courts of the several courts to adjust the rates. The bill also requires all local and long-distance telephone companies to make connection so that messages may be transferred from one line to another. D.

Electrical Inspection Law for Philadelphia.

Chief McLaughlin, of the Philadelphia Electrical Bureau, favors the passage of a bill, now before the Pennsylvania Legislature, empowering the Electrical Bureau to inspect and control all the electric light, heat and power used in the city of Philadelphia.

Chief McLaughlin has been in consultation for several months with electrical contractors of the city, and it was agreed that the bill, while providing no hardships, will result in safe-guarding the public and bringing the city an additional revenue of about $90,000 yearly.

Under the provisions of the bill electrical contractors will be compelled to pay a license fee of $100 the first year and twenty-five dollars the second year. Electrical engineers will pay a license fee of twenty-five dollars.

New German Electric Railway.

With the consent of the Prussian Ministry of Public Works the General Electricity Company and the Siemens-Schuckert Company are to construct an electrical railway between Cologne and Düsseldorf, the trains to do the journey of forty miles in forty minutes. According to the plan submitted by the builders, there will be no terminal stations, but the trains will be run through the streets into the centre of each town. This plan is recommended as an additional convenience to passengers, who can enter the train at many different points in the town instead of losing time by first proceeding to a station passing through a turnstile and buying tickets. Within city limits the speed of the trains will be diminished to eight miles an hour.

Profit-Sharing Plan Offered Employes of Large Electric-Railway and Lighting Company.

Jay P. Graves, president of the Spokane & Inland Empire Electric Railroad Company, operating interurban lines in Washington and Idaho and power plants in and near Spokane, has addressed a letter to the officers and employes of the entire system, setting forth a plan by which they may become stockholders and share in the company's profits. The letter follows:

"A number of corporations in the United States have, during the last few years, adopted plans whereby their employes were afforded opportunities for acquiring their stock or securities on safe and easy terms, believing that thereby employer and employe were brought closer together, to their mutual benefit.

"Believing thoroughly in the principle, and desiring to bring about and maintain between this company and its employes a community of interest and consequent good feeling, the company has arranged with the Union Trust Company of Spokane to supply to any officer or employe of the company shares of its preferred rights or preferred stock at the going market price, plus an interest which may have accrued on the purchase price between the time of purchase by the trust company and its sale, and a commission of five per cent on the amount purchased. No profit is made by the trust company except the commission, it purchasing the stock in the market and selling to the purchaser at cost.

"Easy terms will be made, the purchaser paying not less than fifteen per cent of the purchase price in cash, and the deferred payments being arranged to suit the purchaser, provided that not longer than five years' time will be allowed, the deferred payments bearing interest at five per cent per annum.

"In case the purchaser becomes sick or disabled, leaves the service of the company, is discharged, or dies before the stock is paid for, the Union Trust Company will, if requested to do so, cancel the contract and repay to the purchaser, or, in case of death, to his heirs, all sums paid on account of the purchase price. After the purchase is completed, the company will, in any of the events above stated, take the stock off the hands of the purchaser, or his heirs, at the price paid for same, plus five per cent per annum interest and less any dividends on the shares that may have been paid.

"The par value of the shares is $100, the selling price by the trust company to be the cost, plus commission and interest. Holders are entitled to dividends at the rate of five per cent per annum before dividends are payable to holders of the common stock. Above five per cent, up to seven per cent, the two stocks share equally in dividends. The shares are redeemable at any time by the company upon the payment of $135 a share and accrued dividends. Owing to the recent financial depression, it is believed that the shares can now be purchased for less than par."

Mr. Graves said that the company's object in offering the foregoing plan is that the employes may become interested in the enterprise and better their condition by sharing in its future success, adding: "The arrangement entered into with the Union Trust Company provides the most liberal terms, the credit of the Spokane & Inland Empire Railroad being back of every employe wishing to purchase stock on time payments."

Annual Dinner of the American Institute.

The annual dinners of the American Institute of Electrical Engineers have always proved to be most successful and pleasant gatherings, as they bring together in a social way the leaders of the electrical profession. The dinner this year, which has been set for March 11 at the Hotel Astor, New York city, promises to be a particularly brilliant occasion, as it will celebrate the completion of the first quarter of a century of the Institute's existence. The historical significance of the gathering is receiving special consideration by the committee of arrangements appointed by President Louis A. Ferguson, which consists of T. C. Martin, chairman, G. H. Guy, secretary, T. Beran, M. Coster, M. M. Davis, H. A. Foster, G. A. Hamilton, R. T. Lozier, W. McClellan, F. A. Muschenheim, H. W. Pope, C. W. Price, F. A. Scheffler, E. A. Sperry, A. Spies and A. Williams.

Mechanical and Electrical Engineer.

The United States Civil Service Commission announces an examination on March 17 at the usual places to secure eligibles to fill a vacancy in the position of mechanical and electrical engineer, $1,200 per annum, Quartermaster's Department at Large, Fort Bayard, N. M., and similar vacancies as they may occur in any branch of the service.

The examination will consist of the following subjects, weighted as indicated: Mathematics and practical calculation, 15; drawing, involving machine construction, 15; materials employed in machine construction, 10; theory and practice of electrical engineering, 35; training and experience, 25.

Applicants who have not had at least five years' practical experience in mechanical and electrical engineering will not be admitted to this examination. Graduation in mechanical or electrical engineering will be considered as equivalent to not less than three years of this period. Applicants should at once apply to the United States Civil Service Commission, Washington, D. C., for application form 1312.

Telegraphs in the United States.

The United States Department of Commerce and Labor, through its Bureau of the Census, has completed a preliminary report on the telegraphs in the continental territory of the United States, exclusive of Alaska, Hawaii, the Philippine Islands and Porto Rico. The statistics relate to the years ending December 31, 1907 and 1902. The totals include reports of commercial land telegraph companies owned and operated within the United States, and of domestic ocean cable companies operating from the United States, but do not include telegraph lines operated by railway companies.

	1907.	1902.	Per Cent of Increase.
Number of systems or companies	25	25	0.0
Miles of single wire (exclusive of ocean cable)	1,577,961	1,318,350	19.7
Nautical miles of ocean cable	46,301	16,677	177.7
Messages, total number	103,794,076	91,655,287	13.2
Total income	$ 51,583,868	$ 40,930,038	26.0
Total expenses (including taxes, interest and fixed charges)	41,879,613	30,948,034	35.3
Total cost of construction and equipment (including real estate)	210,045,959	161,679,579	29.9
Capitalization:			
Capital stock authorized, par value	161,603,900	123,233,075	31.1
Capital stock outstanding, par value	155,089,575	117,053,525	32.5
Dividends on stock	7,477,083	6,256,693	19.5
Bonds authorized, par value	83,004,000	49,893,000	66.4
Bonds outstanding, par value	65,204,000	45,893,000	42.1
Interest on bonds	2,651,511	1,949,150	36.0
Total par value stock and bonds outstanding	220,293,575	162,946,525	35.2
Employes and wages:			
Average number	28,034	27,627	1.5
Total salaries and wages	$ 17,808,249	$ 15,039,673	18.4

The final report for 1907 will contain, in addition, an analysis of the above totals and present in detail statistics for other phases of the telegraph and cable industry of the United States.

Two Unique Gasolene-Electric Autotrucks.

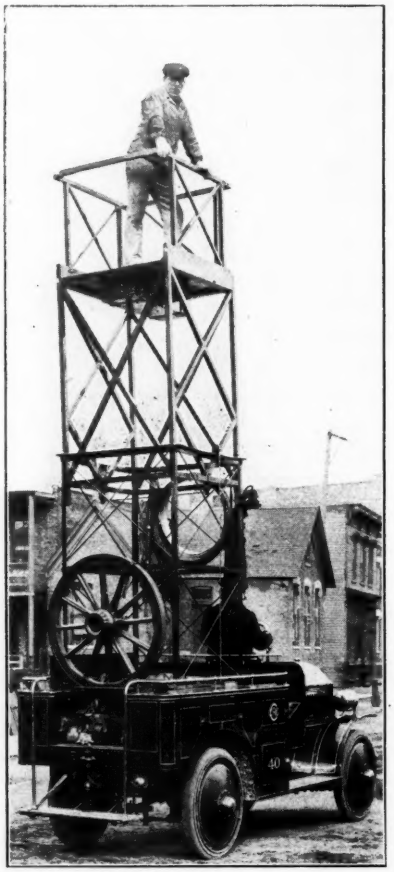
A unique example of the gasolene-electric type of automobile is the new emergency wagon recently placed in the service of the Chicago City Railway Company. An accompanying illustration shows this machine, the first and only one of its kind ever built, with the tower extended in position for making line repairs.

The wagon is primarily driven by a four-cylinder, four-cycle, fifty-horsepower gasolene engine, which is direct-connected to a ten-kilowatt direct-current generator. Through a five-position drum controller this supplies current at pressures ranging up to 150 volts, depending on the speed of the engine, to the four three-horsepower motors located one inside each wheel. The controller has five positions, including the series and multiple starting and running notches, but in the maneuvering of ordinary operation it is thrown directly to the last position and the speed governed at the engine. At the driver's seat there is thus the usual gasolene-engine controlling apparatus, including gas, air and spark levers, besides the electric controller.

This emergency automobile is constructed on the general lines of a touring car, the part usually occupied by the tonneau being used as space for wrecking tools and as a base for a regular line-repair tower. This aerial structure is raised by hand by means of a crank. Although built of steel, the tower is effectively insulated from ground, resting on the wood body of the wagon. The vehicle is also especially useful in removing from the tracks broken-down coal wagons and other obstacles to traffic, even when weighing ten tons or more. Although the combined rating of the four three-horsepower motors is twelve horsepower, they are capable of momentary development of forty horsepower, and are designed to exert 200 per cent overload for two minutes, or twenty-five per cent overload for ten hours, without injury.

Considerable interest attaches to the manner of applying the electric power to the driving of the wheels. This is done through the use of the "couple-gear" construction, on which the patents are controlled by the Couple-Gear Freight-Wheel Company, of Grand Rapids, Mich., which built this emergency wagon. The couple-gear action is shown clearly in two views of one of the wheels, reproduced herewith. In the edgewise view the tire has been removed.

The field pole and bearing structure is mounted rigidly on the stationary axle. The armature rotates about a horizontal axis, communicating through pinions on each end of its shaft, to the annular racks near the rim of the wheel. As shown in the edgewise view the armature shaft

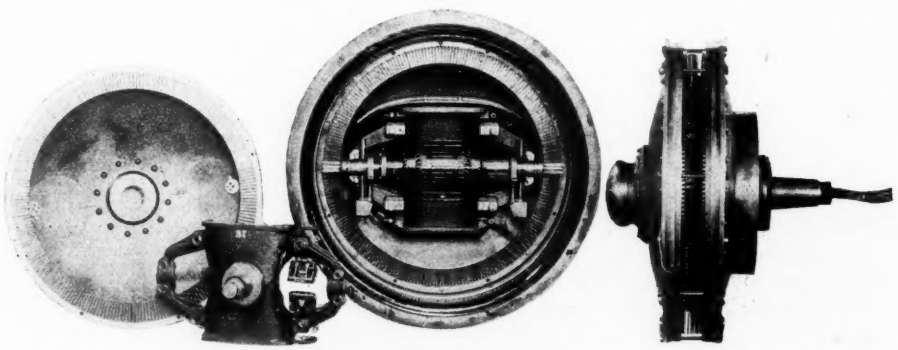


GASOLENE-ELECTRIC EMERGENCY WAGON OF THE CHICAGO CITY RAILWAY COMPANY.

is given a slight angular set in a horizontal plane, so that one pinion engages with the inner and the other pinion with the outer rack, driving both in the same direction of rotation. An equalizing device enables both pinions to exert an equal force, regardless of wear or adjustments. The axle stub on which the wheel turns is integral with the motor casting, insuring perfect alignment of the bearings. The gear reduction ratio is twenty-five to one and is accomplished without the aid of countershafts. The couple-gear action, it is seen, applies the power equally to both sides of the wheel at points near the rim where the greatest mechanical advantage is secured.

The wheels are of saucer-shaped quarter-inch boiler steel which forms the equivalent of spokes. The motor and motor frame are contained in the dustproof casing formed by the cupped wheel sides and the wheel rim. Plain roller bearings are used. The axle frame is the same front and rear and is of wrought steel, braced with cast-steel trusses. This affords a wide support for the cast-steel steering knuckles which carry the motor wheels. Flexible cables connect the motors, through the centre of the wheel axle, to a plug and receptacle which make the connection with the power plant and controller.

In steering from the four wheels the rear wheels swing in the opposite direction from the front wheels, the degree of deflection being the same. All four wheels are actuated simultaneously from the single handwheel. Compared with two-wheel steer the deflection of the wheels is but one-half for the same turn. The truck will turn in an extremely short space and can be driven backward equally as well as forward. This convenience is especially appreciated in congested traffic and in getting through soft places where the rear wheels follow exactly in the tracks of the forward wheels. Each of the four wheels is fitted with a fiber brake-band. Two pedals are used, one for the front wheels and one for the rear wheels, giving two independent brake outfits.

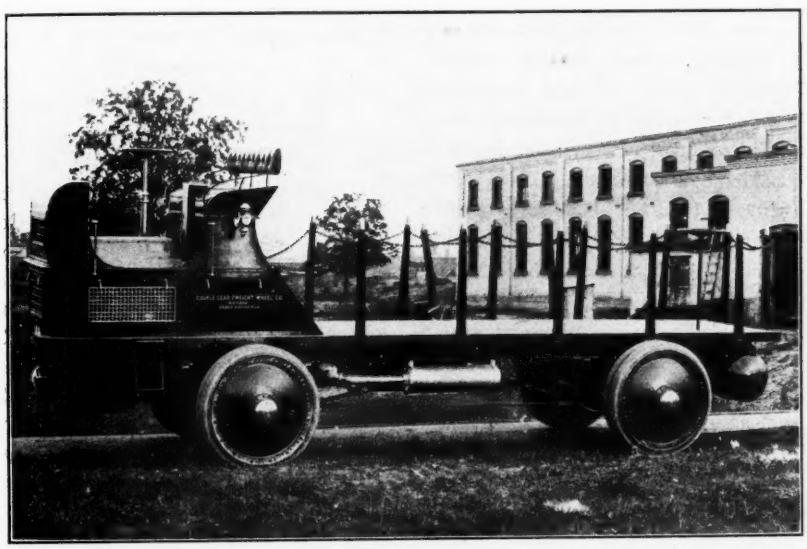


THE "COUPLE-GEAR" WHEEL, SHOWING STATIONARY MOTOR FRAME, THE ARMATURE PINIONS AND ANNULAR RACK. IN THE EDGEWISE VIEW THE TIRE HAS BEEN REMOVED.

The use of the couple-gear principle has been found especially effective in increasing the tractive performance of a given storage-battery capacity, and the company

has built a number of trucks employing the couple-gear drive with simple storage-battery power.

A five-ton gasolene-electric truck was recently built for the Carnegie Solar Observatory at Pasadena, Cal., the machine being used to haul astronomical apparatus up the heights of Mount Wilson. The great weight of many of the parts of the huge telescope and the extreme precipitance of the ascent called for the employment of mechanical power in moving the apparatus. The truck, which in its mechanical features is quite similar to that of the Chicago Street Railway Company, is illustrated herewith. The trail up the mountain is nine miles long, and in that distance ascends to a height of one mile. Many of the turns in the road are so narrow and short as practically to make it



GASOLENE-ELECTRIC TRUCK USED TO TRANSPORT CARNEGIE SOLAR OBSERVATORY EQUIPMENT, ON NARROW TEN PER CENT TRAIL, UP MOUNT WILSON, CAL.

impossible to negotiate them without steering all four wheels. In addition to the regular mechanical brakes this truck is equipped with an electric brake which converts the motors into generators, passing the current generated through three points of resistance. This feature was necessary because of the otherwise severe tax on the driver during the long descent and as an additional safeguard. This truck can be turned around in a space of twenty-three feet without backing, the rear wheels following exactly in the track of the forward wheels the same as on a straight course. Steering can be done equally as well in either direction. The steering device for the rear wheels is an exact duplicate of that used for the forward wheels, and all four wheels turn at the same time and from the same hand-wheel. There is a brake on every wheel and each pair is operated independently. The rear wheels may also be locked and steering effected from the front wheels only. In the oblique steer the four wheels are all turned in the same direction.

Electrical Section, Western Society of Engineers.

On the evening of February 5 there was delivered before the Electrical Section of the Western Society of Engineers an interesting lecture on the "Polarization of Electric Waves," by Prof. Jagadis Chunder Bose, director of the department of physics at Presidency College, Calcutta, India. At the request of Chairman Wm. B. Jackson, Dr. E. H. Lewis introduced the speaker.

Professor Bose began his address by referring to the range of susceptibility of our senses to vibratory impulses. Just as in air, there may be produced vibrations that are to us audible or inaudible as sounds, so in the ether there may be produced high-frequency vibrations that result in a visual effect on the eye, while similar vibrations of a different range of frequencies produce no effect on us. These latter vibrations are set up by an electrical stimulus and are therefore called electric waves. They were first studied by Hertz. The main portion of the lecture was devoted to showing that these waves obeyed the same laws as light waves; the speaker, therefore, referred to them generally as "invisible light."

The lecturer demonstrated by delicately arranged apparatus that this invisible light could be passed through brick, stone and similar objects opaque to ordinary light, while metals and the human hand, among other things, were opaque to it as well. Those objects found to be opaque were shown to be capable of reflecting the waves. The laws of refraction were likewise found to hold true for electric waves as they do for light waves. Polarization by the grating principle was discussed and demonstrated. If the polarizer and analyzer are parallel the waves pass through, if at an angle they do not pass. Among the objects found to have refractive or polarizing properties on the waves were many crystals having certain cleavage lines, also wood and human hair.

At the close of the lecture, Professor Bose described, in response to questions, his method of determining that the waves he had produced were of about one centimetre length and his investigations of cohering substances. In the latter field he found that there were two classes of substances, one which increased in resistance when subjected to the action of the waves and another which decreased in resistance under these influences. He also found several metals, among them potassium and magnesium, that possessed a recuperative property in this respect, potassium being particularly self-recovering. The speaker believed that if the elements are arranged in periodic order, they will naturally group themselves in alternate sets that increase and decrease in resistance under the action of electric waves. He also described how some substances turn the plane of polarization to the right and others to the left and showed that a book has excellent polarizing properties.

Coming Technical Society Meetings in New York.

The following meetings will be held in the Engineering Societies Building, New York city, during the remainder of February. The name of the secretary of the society follows its title: February 16, New York Society of Accountants and Bookkeepers, T. L. Woolhouse; New York Telephone Society, T. H. Laurence. February 17, New York Electrical Society, G. H. Guy. February 19, New York Railroad Club, H. D. Vought. February 23, American Geographical Society, A. A. Raven; American Society of Mechanical Engineers, C. W. Rice; New York Society of Accountants and Bookkeepers, T. L. Woolhouse. February 24, Municipal Engineers of New York, C. D. Pollock.

Hudson River Electric Power Company.

A report made by Stone & Webster to James R. Hooper, chairman of the bondholders' committee of the Hudson River Electric Power Company, has been published. It deals with the "Physical condition, the facilities for operation, the storage possibilities, the undeveloped powers, the business done by the companies and their contracts for furnishing power." There are two groups of properties, those in the Hudson Valley, and those at or near Utica. The Hudson Valley properties are largely operated by waterpower, but are supplemented by a small steam installation of their own and by larger ones of their customers. The Utica system is entirely steam operated.

The company is operating under franchises in Amsterdam, Ballston Spa, Canastota, Cohoes (power only), Glens Falls, Oneida, Saratoga and Watervliet. It has franchises in a number of cities, but is not operating in them.

In the following cities the company has no franchises, but is selling energy at wholesale: In Albany to the Albany Illuminating Company; Troy, Waterford and Lansingburgh, to the Beacon Electric Company; Schenectady, Loudonville and Rotterdam Junction, to the Schenectady Illuminating Company; and in Mechanicsville and Stillwater to the Half Moon Light, Heat and Power Company.

The following abstract shows the consolidated operating statement of the Hudson River Electric and controlling companies for the seven months ended July 31, 1908, based on the report of Messrs. Niles & Niles:

SEVEN MONTHS.

	Gross.	Net.	Adjustments.	Interest Charge.	Surplus.
All companies	$637,161	$320,266	$51,629	$348,947	*$ 80,310
Hudson River Electric Power	94,794	*13,140	33,476	149,774	*196,391
Hudson River Water Power	285,000	219,856	4,244	144,975	70,636
Hudson River Electric Company	77,937	15,072	9,409	110	5,552
Saratoga Gas, Electric Light & Power	60,864	7,542	2,084	3,767	1,689
Ballston Spa Light & Power	16,822	6,932	252	1,267	5,412
Empire State Power Company	32,200	5,253	1,473	6,125	*2,345
Madison County Gas & Electric	30,633	1,445	742	7,465	*6,762
Hudson River Power Transmission	104,357	77,307	†53	35,463	41,897

*Deficit. †Credit.

The approximate value of the physical properties of the Hudson River Companies shows as follows (not including land, rights-of-way or investments in undeveloped properties):

Spier Falls plant	$2,250,000
Mechanicsville plant	787,500
Schoharie Falls plant	250,000
Utica plant	750,000
Oneida plant	54,000
Substation and switch houses	493,000
Tower lines and telephones	121,900
Pole lines and telephone	173,000
Insulators	39,000
Wire	553,000
Distribution lines	431,000
Saratoga gas plant	265,000
Madison County gas plant	68,000
Total	$6,234,000

Electric Smelting Furnaces in Sweden.

Dr. Eugene Haanel, director of mines for Canada, has returned from an important visit to Dumnarfvet, Sweden, where he has been inspecting a new electric smelting process. As a result, he is confident that the new method is a commercial success. What this means for Ontario and Quebec, with their enormous supplies of iron ore, abundant waterpowers and lack of metallurgical fuel, is at once apparent. In his preliminary report on the experiments at Sault Ste. Marie, in 1905, Dr. Haanel stated that the furnace there tried needed certain modifications to render it a commercial possibility. This report awakened lively interest in Sweden, where the conditions are similar to those of central Canada. A company was organized, able young engineers were put in charge, work was carried on for a year-and-a-half at a cost of $102,000, and the furnaces were built, each showing correction of faults observed in preceding ones. Upon attaining what it considered a commercial furnace, the company invited Dr. Haanel to inspect and pronounce upon it. This furnace is much like a blast furnace, in which the tuyeres, for introducing the blast, are replaced by electrodes. A three-phase current is employed, and about 700 horsepower is delivered to the furnace. Dr. Haanel assured himself that the furnace in every way met his expectations as a solution of the problem of constructing an electric furnace on a commercial scale. The furnace worked very quietly, and the charge passed down the shaft gradually and uniformly, the electrodes requiring no regulation, not having been moved for five days. In addition to this work at the Dumnarfvet works, there has been invented a steel furnace in which a three-phase current and two electrodes are used, the bottom of the furnace furnishing the third electrode. The special advantage of this construction is that the three-phase current produces a rotation of the bath in a vertical plane, thus bringing new material continually into the slag line for purification. W.

Electrical Contractors' Association at Toledo.

The National Electrical Contractors' Association will hold its convention in Toledo, July 21, 22 and 23. To make arrangements for the coming meeting, the following members of the national committee recently met at the Boody House, in that city: President G. M. Sanborn, Indianapolis, Ind.; Secretary W. H. Morton, Utica, N. Y.; E. McCleary, Detroit, Mich.; Charles B. Kreider, Chicago, Ill., and J. H. McMaster, Columbus, Ohio. The programme will include a banquet and other entertainment features, in addition to a discussion of subjects important to the trade. The local committee, which will have charge of details, consists of M. W. Hanson, Charles M. Eddy and Emil Grah. It is expected that between 300 and 400 electrical contractors will be in attendance. H.

Editors Inspect New Haven System.

A number of the technical editors of New York were the guests of W. S. Murray, electrical engineer of the New York, New Haven & Hartford Railroad Company, on a locomotive inspection trip to Stamford, Conn., and return on Friday of last week. There were about fifteen in the party, and seats were provided in the electric locomotives. The visit to the shops at Stamford impressed the editors with the small amount of repair work that is evidently necessary. About seventy-five men are employed at the shops in night and day shifts, their chief duty being to carefully inspect each locomotive after its run. The trip was an enjoyable and particularly valuable one for the technical writers of the electrical and railroad press, all of whom are naturally interested in the developments respecting steam-road electrification.

Westinghouse Company Turns Over New Haven Electrification.

The New York, New Haven & Hartford Railroad is now in full possession of the electrical equipment of the road, which was turned over to its officials February 1. Up to that time the Westinghouse Electric and Manufacturing Company had kept a small force of experts at the Cos Cob shops. They have now been withdrawn, and the railroad's employes will now have full charge. During the past year the Westinghouse company has completed the reconstruction of the thirty-five electric locomotives the railroad company ordered of it originally.

Electrical Notes from Great Britain.

(By our British Correspondent.)

"Science is on the march, and under her silent footsteps all that is vague and crude and unreasoned will tend in time to disappear." Such is one of the concluding sentences of a paper on the filtration and purification of water for public supply, read before the London Institution of Mechanical Engineers by John Don on January 15. The paper claims mention here because of an interesting section of it wherein purification by ozone was dealt with. Ozone is best prepared by the silent discharge of high-tension electricity through perfectly dry air, and most of the devices employed in the process are described as "adaptations of the Siemens ozonizer," which—for example—is used at Wiesbaden as designed by Siemens & Halske. To operate this instrument a voltage of about 80,000 is required, and the generator absorbs one horsepower. The amount of ozone varies from 13.5 to twenty-seven grammes per hour, the rate of production depending on the dryness of the air which enters the apparatus. This quantity of ozone will purify from 2,200 to 4,400 gallons. There are nine ozonizers in operation at Wiesbaden. At Paderborn also the water supply is purified by ozone, from twelve to sixteen thousand gallons per hour being passed through. The ozone is applied to the water as it descends through gravel beds, the current of ozonized air being forced up from below. More recent than the foregoing is the ozone installation at Ginnekin, Holland, which purifies the water of the River Mark. Normally this stream is discolored and the number of germs per cubic centimetre is generally about 6,000. Its course lies through fields which are frequently manured from the farmyard. The water from the intake is first passed through filters. Lift pumps raise the filtered water to a tank placed at the top of the sterilizing tower, this tank having a capacity of 45,000 gallons and the pump ordinarily delivering 4,500 gallons per hour. The whole of the purifying apparatus is housed in the tower. Electricity is obtained from a local installation and the 100-volt current is transformed to operate at a pressure of 65,000 volts. Schneller pattern ozonizers are employed, which do not differ in principle from those already mentioned. The outer electrode is hemicylindrical in shape and is kept cool by water circulating in a cast-iron jacket. The inner electrode is the insulated one, and it is of the same form as the outer one but of less radius. The cost of working at Ginnekin is about $9.50 per million gallons.

Mr. Don in discussing relative advantages said that costly as this process of purification may be, it is probably one which is well worth the sacrifice of a little money when it furnishes unexceptionable drinking water from a source like the River Mark. Experience at many stations with ozone purifiers indicates that a fair proportion of the ozone goes to waste. Different waters, of course, make different demands on the purifying agent, and Mr. Don recommended that tests be made to determine the minimum quantity of ozone that can with safety be applied, as not only would this be in the interests of economy, but it would prevent traces of the ozone being carried to the consumer. The Howard-Bridge system, in which the last-named advantage is secured, was mentioned, as was also the de Fries system which had been tested at St. Maur on a large scale, and the Vosmaer system which had a special device for overcoming some difficulties in insulation and establishing a purely silent discharge.

The London County Council's section of tramways on which the "G. B." surface contact system is employed, continues to be a prominent subject for discussion. It will be remembered that the Council obtained a report on the equipment with recommendations as to future action in regard to it from W. M. Mordey, the president of the Institution of Electrical Engineers. All that has happened since then need not be now related, but it is understood that an understanding has been reached between the G. B. Company and the Council under which the former will put one mile of the track already laid into a satisfactory workable condition, and will also provide a car with the "G. B." standard collecting equipment instead of the one so far employed in which some of the Council's own ideas are embodied.

The annual return has just been issued concerning tramway undertakings in the United Kingdom. There are 305 systems with 2,464 miles of line and 12,049 cars. Municipal corporations own 1,620 miles upon which a capital expenditure of $220,000,000 has been incurred; the remaining 844 miles owned by companies representing $136,000,000. All the undertakings are electrically run except the following: Fifty-two miles of steam tramway, twenty-seven miles cable, four miles gas, and ninety-four miles horse. Passengers carried during the year totaled 2,626 millions; 432 million units of electricity were consumed. The gross receipts were just over $62,000,000 and the working expenses were $39,000,000. The increase as compared to the preceding year was seventy miles.

It will be remembered that close upon a year ago much discussion was in progress concerning the draft regulations which had been drawn up for the Home Office for insuring the safer working of electrical installations in workshops and factories. We mentioned the matter at the time. A circular accompanying the original draft dwelt upon the possibilities of fatalities occurring from low-voltage shocks. The regulations were circulated among electrical manufacturers and electricity suppliers, and a great storm of hostility was aroused which found expression at the many days' inquiry held under the presidency of J. Swinburne, F. R. S., who acted as the Home Office commissioner. It is some ten months since the conclusion of the inquiry, but it was recognized that not even so eminent an expert as Mr. Swinburne could in a few days steer safely through all the rocks and prepare an altered set of regulations which would meet reasonable objections and at the same time have sufficient regard for the safety of the worker. His report was issued in January as a Parliamentary paper, and among other things it states the objections and names amendments which he considers justifiable in order to meet them. The regulations as first circulated in draft form were suggested for application in the case of all installations carrying pressures of 130 volts continuous and sixty-five volts alternating. Although a number of deaths have occurred at very low voltages, it was felt to be quite needless to apply the regulations in whatever form they passed to cases of these kinds. In this respect the report makes an important alteration, stating considerably higher voltages than those named above.

In future all electric tramway and light railway authorities in the United Kingdom will, if they comply with a recommendation that has just been sent out by

the Board of Trade, fit a number of their cars (not all, at present) with speed indicators so that drivers may become accustomed to speed-judging. Inquiries held into some of the electric tramway accidents have revealed the fact that the maximum speeds agreed upon with the Board of Trade have been exceeded, and the training of the motorman in watching speed indicators is recommended as a likely way of preventing much of this in future.

The advice has often been tendered to tramway authorities that when reckoning up and dividing their profits they should be more generous in building up reserve funds for repairs to permanent way and rolling stock and also for renewals. Some companies and municipalities paid heed to the advice, though in some cases the greater regard that they paid to the matter was more the result of their own painful practical experience and the claims made by their wearing tracks and depreciating cars. It was, of course, a matter in which engineers and managers had to feel their way, whatever experience might have been available concerning small slow-speed horse cars being of no value in calculating the wear and tear resulting from the very different circumstances of electric traction. But some officials—or ought we to say financial authorities?—took longer to feel their way than might have been considered necessary, and the criticism has been urged against some companies that they paid away in dividends what really ought to have been retained in the coffers to meet the year's share of depreciation of the system. We have now perhaps about got to the end of short-sighted policies, so imperative are becoming the demands of wearing tracks, and it is little use now saying what a pity it was that a more far-sighted policy was not adopted when it was urged. While on this subject we may quote from a statement issued by the board of the London United Tramways Company, which owns many miles of electric trolley line in London and outside: "In view of the necessity for providing ing funds to meet future renewals, the strengthening of the reserve funds, which the directors had hoped would have been possible out of increased receipts, should in the permanent interests of the preference shareholders themselves be no longer delayed, and for the present the payments on account of preference dividend should be limited to two-and-one-half per cent per annum" (instead of five per cent). This company has a large proportion of its capital in ordinary shares, upon which it cannot at present pay a dividend, though as recently as the year 1904 it paid the full preference dividend and six per cent per annum on the ordinary.

The snowstorm which visited the United Kingdom during the closing days of last year gave our tramway managers some useful, because unusually severe, experience in track-clearing, and in many cases services had to be suspended. London had an experience all its own with its underground conduit lines, owing to salt troubles. From many towns in the country interesting reports have been made to some of the tramway publications telling what emergency methods were adopted in coping with the difficulty. We will just briefly mention the case of Aberdeen. Here the snow fell to a depth of some three feet, not reckoning drifts, and as the snowplows proved useless, some 900 men cleared a number of the routes as expeditiously as possible; then the snowplows were kept continuously at it all night and two out of seven routes were kept open. About 300 tons of salt were used, little damage to the car equipments resulting. At the outbreak of the storm the cables under the cars were painted with thick paint, the motors being also rendered water-tight. For some three days some four miles of country track remained entirely blocked.

ALBERT H. BRIDGE.

London, January 30, 1909.

Ohio Electric Light Association.

The fifteenth annual convention of the Ohio Electric Light Association will be held at Toledo, July 13, 14 and 15. In selecting the month of July the committee believed that this was a better time for electric-light men to leave their stations and the hotels less likely to be crowded.

The programme, so far as arranged, covers the following subjects: "The Titanium Arc Lamp;" "Factors That Should Be Considered in Determining the Price to Be Charged for Street Lighting;" "Boiler-room Economy;" "Engine-room Management;" "The Commercial Organization of an Electric-Light Company and Its Relation to the Public;" "Reports and Discussion on Tungsten Lamp Experience;" "The Supply of Current for Lighting to Other Towns from a Centrally Located Station;" "Report on Plans That Should Be Followed in Lamp Renewals."

C. R. McKay is president and D. L. Gaskill, secretary and treasurer of the Ohio Electric Light Association.

Electrical Show for Louisville.

With a view to the development of the electrical arts in the South in general and in the Falls Cities, Louisville, Ky., New Albany and Jeffersonville, Ind., in particular, the Southern Electrical and Industrial Exposition Company has arranged for an exhibition, chiefly electrical, to be held April 12 to 24, 1909, in the Armory of the First Kentucky Regiment at Louisville. The large drill room in this building has an area free from pillars or any other obstructions of 270 by 200 feet. Besides this 54,000 square feet of floor space, a high well-kept basement beneath it and of 30,000 square feet area is available for heavy operating machinery.

The plans for the exposition are practically complete. The decorative features have been designed by Brinton B. Davis, a Louisville architect. One of the chief attractive features will be a central electrical tower 100 feet high. The booths are to be tastefully constructed and illuminated by the exposition company. Natiello's Band will furnish music throughout the exhibition.

The Southern Electrical and Industrial Exposition Company has been duly incorporated with the following officers: Fred W. Keisker, president; Julius V. Beckmann, first vice-president; Frank C. Nunemacher, second vice-president, and A. T. MacDonald, secretary. The board of directors and advisory board consists of about forty men prominent in the leading circles of Louisville and its neighboring cities. Active support to the electrical show has been provided by the Louisville Commercial Club, the Board of Trade, the Merchants' and Manufacturers' Association, the Retail Merchants' Association, the Builders' Exchange, the New Albany Commercial Club and the Jeffersonville Commercial Club.

Westinghouse Company Restores Scale of Wages.

The Westinghouse Electric and Manufacturing Company has restored to its 3,000 employes the rate of wages that was paid before last March, when a policy of retrenchment was put into effect.

Last spring the salaries of $75 men were cut five per cent; salaries from $75 to $100 were cut seven-and-one-half per cent; salaries from $100 to $150 were cut ten per cent, and from $150 to $200 were cut fifteen per cent, and so on up the line.

The reduction meant an average monthly cut of $15 for each of 3,000 employes of the company.

The Hudson-Fulton Celebration.

A commission has been appointed in New York state to arrange for the celebration in September of this year, of the three-hundredth anniversary of the discovery of the Hudson River by Henry Hudson in 1609, and the one-hundredth anniversary of the successful application of steam to the navigation of the river by Robert Fulton in 1807. The postponement of the celebration of the centenary of steam navigation from 1907 to 1909 in order that it might be combined with the celebration of the tercentenary of Hudson's voyage, was deemed advisable for the reason that the two historic events occurred on the same river and their anniversaries come so close together as to make separate commemorations upon any large scale inexpedient.

The people of Holland, under royal auspices, are building a reproduction of the Half Moon, to be manned with a crew in the costumes of the period of Henry Hudson. The reception of this distinguished delegation, together, as it is hoped, with ships and official representatives of foreign nations, will mark the international phase of the celebration.

The national government will be represented by the Federal troops, the United States Navy, and distinguished civil officers, and various state, county and city bodies will join in making memorable this double celebration.

The celebration will begin September 25 and last for eight days in and around Greater New York, and the next week in the cities up the Hudson River as far as Troy. There will be land and naval parades and exhibitions of paintings, books, models and relics relating to the periods marked by these celebrations.

A reproduction of Robert Fulton's original steamboat, the Clermont, will cast off from the site of the dock of the epochal voyage a century ago, and steam up the river over the same course traversed on the famous trip of 1807. Both the Clermont and the Half Moon will be taken up the river for the up-state celebrations to continue during the second week.

The Hudson-Fulton Celebration Commission, which comprises 365 appointed members, has arranged an elaborate programme for the occasion, and it is believed that the event will surpass anything ever attempted in the way of a similar historical observance.

Herman Ridder is acting president of the Commission, which has offices in the Tribune Building, New York city, in place of the titular president, Gen. Stewart L. Woodford. The vice-presidents are Andrew Carnegie, Hon. Joseph H. Choate, Maj.-Gen. F. D. Grant, Hon. Seth Low, J. Pierpont Morgan, Hon. Levi P. Morton, John E. Parsons, Gen. Horace Porter, Hon. Frederick W. Seward, Francis Lynde Stetson, Hon. Oscar S. Straus, Wm. B. Van Rensselaer, Hon. Andrew D. White, and Gen. Jas. Grant Wilson. Henry W. Sackett is secretary, and Isaac N. Seligman, treasurer.

Effect of Texas Legislation on Telephone Revenues.

It is held by J. E. Farnsworth of Dallas, vice-president and general manager of the Southwestern Telephone and Telegraph Company, which is a Bell concern, that it would be in violation of the anti-pass act for his company to make certain reductions in tolls for long-distance telephone service. His company has received applications for such reductions from the business men of Houston and other cities of the state. In reply to these requests Mr. Farnsworth made an interesting statement as to the effects of Texas legislation upon the earnings of his company. He said:

"I am not prepared to give the business men of Houston or any other city in the state the slightest encouragement on the proposition at this time. I am going to say something now that I do not suppose any representative of our company ever uttered before—at least for the information of the public. The Legislature of Texas has done a good many things that have resulted in reducing the revenues of the corporation. So far as we are concerned the enactment of the anti-pass law was bad enough, but when it drove what we commonly called the 'bucket-shops' out of the state, it took from us one of our best sources of revenue. People differ quite materially on the question of the 'bucket-shops,' and I do not favor them personally any more than the next man. But our company is engaged in a legitimate business, and so far as I know our business with the bucket-shops was legitimate. In 1906 our revenues from the wire business amounted to $205,000. Of course a good portion of this came from the bucket-shop business. In 1907 this business dropped down to $99,000, and in 1908 it was only $30,000, while our long-distance business for the year 1908 increased only $40,000 over 1907. During the same period we had a heavier investment of between $75,000 and $100,000.

"I know the attorney-general of the state decided that the anti-pass law did not affect our business, but our own general attorney advised us differently. The opinion of the attorney-general is only advisory and the company simply decided not to take any chances on the penalty provided. The law provided a fine of $5,000 and an imprisonment of two years in the penitentiary for each and every violation. I am firmly convinced that the company is in no position to reinstate the coupon system or grant any other concessions that would be considered a discrimination in the matter of rates, and I see no reason for placing the business of the company under the regulation of the railroad commission.

"I believe that business men ought to be conservative and reasonable when it comes to dealing with public service corporations. Our company has never paid more than a seven per cent dividend on its investment, and there have been but two years that it paid that much. The business men of Houston especially ought to appreciate the difficulties the telephone company has to contend with, the money we have to invest annually to keep our service up to a high standard, the efforts we are constantly making to improve the service and the part we have in the general development of the commercial interests of the state. We are just now contemplating an extension of the system between Houston and Brownsville in order to help the business interests." D.

Navy Department Supplies.

The Bureau of Supplies and Accounts, Washington, D. C., will open bids on February 16 for 15,000 feet of steel-enameled conduit and 400 enclosed fuses, for delivery at Brooklyn, N. Y.

Bids will be opened on February 23 for six blowers and twelve heaters, for delivery at Philadelphia, Pa.; 1,100 pairs of carbons, eighty-five cells, 500 lamps and miscellaneous supplies, for delivery at Washington, D. C.; 12,000 feet rubber-covered wire and miscellaneous supplies, for delivery at Portsmouth, N. H.; miscellaneous wire, for delivery at Boston, Mass.; three cabinet and panel boards, miscellaneous clusters and supplies, and 20,000 feet of duplex wire, for delivery at Norfolk, Va.; 1,000 pounds communication cable, 1,000 pounds cotton tape, and 500 pounds of rubber tape, for delivery at Brooklyn, New York.

Power from Coke-Oven Gas.

While the adoption of gas engines operating on by-product coke-oven gas is becoming active in this country, Japanese industries are also recognizing its advantages. The Furukawa Coke Works, Japan, recently ordered through Takata & Company, Japanese agents for the Westinghouse interests, an extension to their present gas-engine plant, which has been in service at the coke works for some time. The new equipment comprises a Westinghouse vertical single-acting gas engine. This order, although not large, illustrates the recognition of the advantages of the gas-power system as well as the dependence which the Japanese people place in American-made machinery. A similar equipment has been ordered by the Imperial Printing Office of the Japanese government, although not to operate on coke-oven gas.

Engines of the same size and type have been in operation for several years in the United States at the works of the Semet-Solvay Company, Syracuse, N. Y., and at the Otto coke works, Camden, N. J. The most important application of by-product coke-oven gas has occurred at Lebanon, Pa., where there are now located two plants aggregating several thousand horsepower. Both of these employ the Westinghouse horizontal double-acting type gas engines, solid-coupled to alternating-current generators for power, light and traction service. All of the equipments are of standard Westinghouse construction, and one of these plants, which has been operating for over a year, has thoroughly proven its adaptability, without requiring special design. This plant regularly operates on run-of-oven gas, ranging from fifty to sixty-five per cent hydrogen and one to two grains of sulphur per cubic foot. This plant is at the Lebanon works of the American Iron and Steel Manufacturing Company. The second plant, under construction, is located near Lebanon, at the works of the Cornwall Ore Banks, otherwise known as the Pennsylvania Steel Company, adjacent to the extensive plant of the Semet-Solvay Company.

New York Electrical Society.

The next meeting of the New York Electrical Society will be held in the Engineering Societies' Building, 29 West Thirty-ninth Street, New York city, on Wednesday evening, February 17. Dr. Louis Bell will lecture on "Modern Street Lighting."

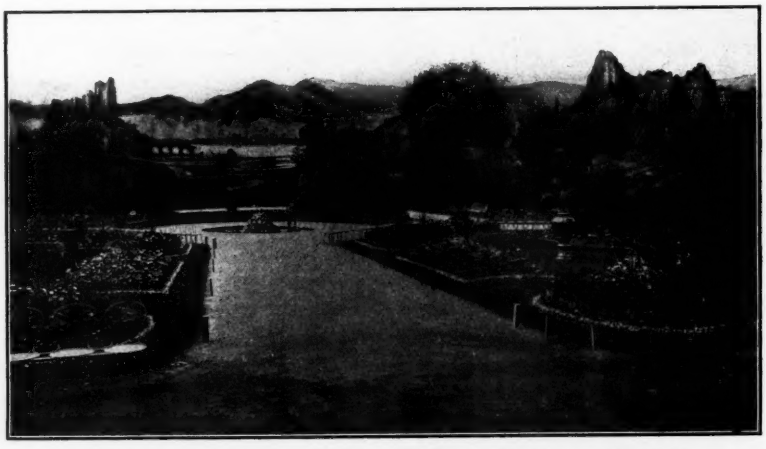
The Golden West and American Industries Exhibition.

Last September announcement was made that an American exhibition, for which all the exhibits will be taken from the United States, would be held in the grounds and buildings of Earl's Court, London, England, from May to October of this year. The exposition will be styled the "Golden West and American Industries Exhibition." Representatives have been appointed to visit the leading cities and all manufacturing districts of the United States.

The exhibition will typify the great development of the states of the "Golden West" since the discovery of gold in California in 1849, and will also commemorate the bicentennial of the completion of the first Atlantic cable.

Earl's Court is in the center of the dense population of London, which makes it a peculiarly desirable point from which to display the convincing evidences of the industry and prosperity of this country. It is estimated that 5,000,000 people a week can reach Earl's Court at nominal fares from any section of the great city by quick transit lines.

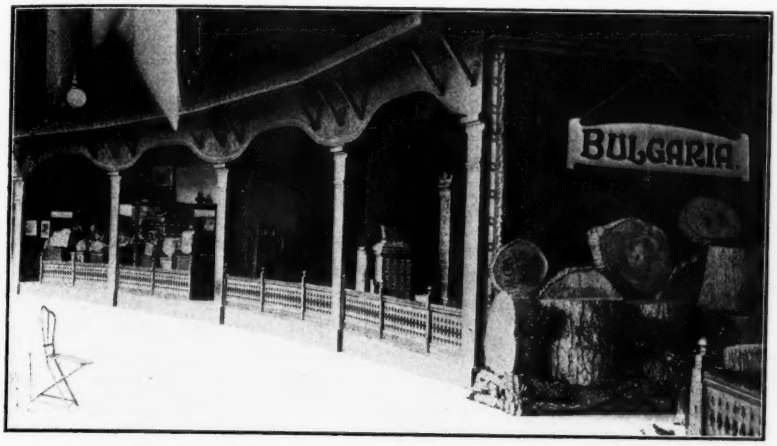
THE FACADE OF THE CHICAGO BUILDING AT THE GOLDEN WEST AND AMERICAN INDUSTRIES EXHIBITION.



THE WESTERN GARDENS, EARL'S COURT, LONDON, ENGLAND.

Ducal Hall has been reserved for Chicago and Illinois exhibitors, and the semicircle surrounding the Palace Gardens has been appropriated for the California exhibition.

The accompanying illustrations give an idea of the character of the exhibition headquarters and of the surroundings of



A TYPICAL BOOTH AT EARL'S COURT, LONDON, ENGLAND.

the exhibition palaces. One shows the facade of the Chicago building, another

THE VILLAGE STREET, EARL'S COURT, LONDON, ENGLAND.

the Western Gardens, and still another a typical booth. Two illustrations show

THE IMPERIAL COURT AT EARL'S COURT, LONDON, ENGLAND.

the assembling of the crowds in the village street, and in the Imperial Court.

The commissioner in charge is John W. Ryckman, and temporary headquarters have been established at the Ansonia, Broadway and Seventy-third Street, New York city.

Inquiries for western representation should be addressed to George W. Sheldon, or the American Marketing Company, Monadnock Building, Chicago.

Electrical Exports for December.

The electrical exports from the United States during December, 1908, showed a substantial gain over the total of the preceding month of November, although the figures of a year before have not been entirely recovered.

The total electrical exports for December, 1908, were valued at $1,199,175, compared with $1,353,512 for December, 1907, and $759,503 for November, 1908. Classified into appliances and machinery, the totals were: Electrical appliances—December, 1908, $611,611; December, 1907, $515,701; November, 1908, $463,588. Electrical machinery — December, 1908, $587,559; December, 1907, $837,811; November, 1908, $295,915.

The principal countries to which electrical exports were made during December, 1908, were:

Electrical appliances — British North America, $161,101; Brazil, $84,192; Mexico, $76,542; United Kingdom, $57,352; Cuba, $44,073; Japan, $39,410; Central American states and British Honduras, $28,821; other South America, $28,036; Argentina, $17,531; Germany, $13,087; Philippine Islands, $12,752; British Australasia, $19,046; British Africa, $8,741; other Europe, $8,403; other West Indies and Bermuda, $6,580; Belgium, $6,462; other countries, $4,609; France, $3,878.

Electrical machinery—Central American states and British Honduras, $100,476; British Australasia, $75,550; British North America, $73,124; Japan, $65,021; Mexico, $44,690; Brazil, $40,715; United Kingdom, $39,746; other Europe, $30,516; Argentina, $26,862; British Africa, $18,151; France, $15,533; British East Indies, $14,139; other Asia and Oceania, $12,944; other South America, $11,724; Cuba, $8,751; Philippine Islands, $2,994; Germany, $1,938; Chinese Empire, $1,334; other West Indies and Bermuda, $971; Hong-Kong, $725.

Cheaper Aluminum in Sight.

The electrolytic manufacture of aluminum was commenced at New Kensington in America in 1888 and at Newhausen in Switzerland in 1889 under patents granted to Hall and to Heroult, respectively. The Bradley patent for keeping the bath in a molten state, which expired last year in Europe, expires this year in America. In Europe aluminum is selling at thirteen cents per pound, while here it is now about twenty-three cents, and will undoubtedly drop when the Bradley patent becomes public property.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

PHILADELPHIA COMPANY.

The Philadelphia Company and affiliated corporations have issued a statement of earnings for the year ended December 31, 1908, which compares as follows:

	1908.	1907.
Gross	$16,583,425	$19,091,423
Expenses and taxes	9,718,870	12,067,303
Net	$ 6,801,555	$ 7,024,120
Other income	245,730	249,365
Total income	$ 7,047,285	$ 7,273,485
Charges	4,483,079	4,186,563
Balance	$ 2,564,206	$ 3,086,922
Pfd. dividend Phila. Co.	300,000	455,053
Surplus	$ 2,264,200	$ 2,631,869
Due owners common stock affiliated companies	3,645	3,101
Surp. available for Philadelphia Company	$ 2,260,561	$ 2,628,768

NEW YORK AND NEW JERSEY TELEPHONE.

The New York and New Jersey Telephone Company reports for the nine months ended September 30, 1908, as follows:

EARNINGS.		
Exchange service	$4,182,219	
Toll service	2,334,777	
Real estate	247,726	
Other sources	114,041	
		$6,878,765
OPERATING EXPENSES.		
General expenses and taxes	$ 566,456	
Procuring and handling traffic	2,020,926	
Maintenance and reconstruction	1,999,311	
Instrument rentals	286,938	
Earnings over operating expenses		$2,005,132
Interest charges	119,330	
Dividends declared	1,324,837	
Total interest and dividends		1,444,168
Surplus for nine months		$ 560,963
Profit and loss account, Dec. 31, 1907		4,832,214
Surplus Sept. 30, 1908		$5,393,178

KEYSTONE TELEPHONE.

The report of the Keystone Telephone Company, of Pennsylvania, for the month of December and six months ended December 31, compares as follows:

	1908.	1907.
December gross	$ 88,854	$ 87,356
Expenses	44,323	45,523
December net	$ 44,531	$ 41,833
Six months gross	528,237	524,636
Expenses	261,778	277,334
Six months net	$266,459	$247,302

LAKE SHORE ELECTRIC.

The Lake Shore Electric Railway (Cleveland) has issued its annual report for the year ended December 31, 1908. The income account compares as follows:

	1908.	1907.
Gross	$ 867,269	$ 913,161
Expenses	490,974	521,559
Net	$ 376,295	$ 391,602
Other income	25,000	25,000
Total income	$ 401,295	$ 416,602
Charges	326,232	294,073
Surplus	$ 75,063	$ 122,529
Per cent. of operation	56.61%	57.11%
No. of car miles	3,339,131	3,392,735
Income per car mile	25.97c	26.91c
Op. and tax per car mile	14.70c	15.37c
Net earnings per car mile	11.72c	11.54c
Passengers carried	4,788,418	4,904,505
Earnings per passenger	18.11c	18.61c

President E. W. Moore says:

"Notwithstanding the fact that there was considerable reduction in operating expense, the property has been well maintained during the year and is now in a better physical condition than ever before. In connection with the earnings, it will be noticed that, while the shrinkage in surplus exceeds the decrease in gross by a trifle over $1,500, the larger part of the loss in surplus is due to the increase in fixed charges, owing to the large addition to the Fremont power plant and the construction of the twenty-mile line between Sandusky and Fremont. With the return of general business to normal conditions the full benefit of these expenditures will be realized."

The report of the company for the month of December compares as follows:

	1908.	1907.
December gross	$67,092	$68,476
Expenses and taxes	39,790	42,934
December net	$27,302	$25,542
Charges	29,106	25,348
December deficit	$ 1,804	*$ 194

*Surplus.

TOLEDO RAILWAYS AND LIGHT COMPANY.

The following is a comparative statement of the earnings, etc., of the Toledo Railways and Light Company, for the past four years. The figures for 1908 include the earnings of the Toledo Gas, Electric and Heating Company, for the entire calendar year.

Income account:

	1908.	1907.
Gross	$2,542,111	$2,565,200
Expenses and taxes	1,473,380	1,542,333
Net	$1,068,731	$1,022,867
Interest	755,425	708,166
Surplus	$ 313,306	$ 314,701
Percentage of capital	2.26	2.27

BELL TELEPHONE COMPANY OF PENNSYLVANIA.

The Bell Telephone Company of Pennsylvania has issued its annual report for the year ended December 31, 1908.

The statements submitted show the results of the operations of the properties during the year, and their financial condition at its close, the combined figures covering the operation of the several companies forming the system, namely, the Bell Telephone Company of Pennsylvania, the Delaware & Atlantic Telegraph and Telephone Company, the Diamond State Telephone Company, the Chesapeake & Potomac Telephone Company, and their subsidiary companies.

Figures comparing the results of 1908 with those of 1907, as presented in last year's report, would be misleading, because of the greater territory operated this year as compared with that operated last year. Hence, such figures are not presented. In the following statement the results for 1907 have been compiled from the books of the several companies and represent operations in the territory covered by the 1908 figures presented in this report. The statement follows:

	1908.	1907.
Gross	$11,434,520	$10,982,638
Expenses	7,980,439	7,712,939
Net	$ 3,454,080	$ 3,269,699
Interest	278,761	679,771
Balance	*$ 3,175,319	$ 2,589,928
Dividends	2,387,422	1,840,218
Previous balance	$ 787,897	$ 749,710

*Equal to 7.61 per cent earned on the $41,550,000 capital stock.

The net gain in stations during the year was 12,148, and the number in service at the end of the year was 316,278. The territory operated covers about 47,000 square miles, and includes a population of approximately 8,000,000. It embraces substantially all of Pennsylvania east of the Alleghanies and south of the northern tier of counties, southern New Jersey, the District of Columbia, the states of Delaware and Maryland and adjacent parts of Virginia and West Virginia.

In the opinion of the board of directors, the grouping of these properties into one system will be productive of many advantages and benefits, both to stockholders and the public.

The board also believes that each of the properties acquired is fully worth the consideration paid for it—whether its value be measured by earning power or cost of reproducing plant and business. The combined value of the several properties as they stood separately will be considerably enhanced by their association into one concern.

METROPOLITAN WEST SIDE "L."

The Metropolitan West Side Elevated Railroad Company, Chicago, has issued its annual report for the year ended December 31, 1908. The income account compares as follows:

	1908.	1907.
Total gross earnings	$2,746,840	$2,878,587
Operating expenses	1,410,801	1,443,498
Net from operation	$1,336,039	$1,435,089
Other income	10,126	6,819
Total income	$1,346,165	$1,441,908
Charges, rent, etc	1,084,750	1,050,123
Surplus	$ 261,415	$ 391,785
Dividends		195,927
Surplus	$ 261,415	$ 195,858
Previous surplus	1,320,291	1,124,433
Total surplus	$1,581,706	$1,320,291
Depreciation and reserve	300,000	
P. & L. surplus	$1,281,706	$1,320,291

The Metropolitan West Side Elevated's total traffic last year was 51,587,667 passengers, or a daily average of 140,950, a decrease of 4.96 per cent from 1907.

President Hetzler says: "The mileage operated is unchanged, being 50.5 miles, exclusive of side-tracks. The equipment

is in first-class condition, and the power house is in thorough repair, materially reducing the cost of operating. During the year all equipment trust notes were retired and funded, the collateral loan was reduced by $10,000 and all accounts payable on or before close of fiscal year vouchered and paid. Traffic has not increased, owing to the depression in general business occasioned by the recent panic, but it is fair to assume that with a revival of business, the road will enjoy its share of increased prosperity. The company is in better physical condition and stronger financially than ever in its history."

LONDON UNDERGROUND.

The Underground Electric Railways of London report weekly gross earnings for the third week of January and three weeks ended January 23, 1909, compared as follows:

Company.	1909.	1908.
Bakerloo	£ 3,375	£ 3,120
Piccadilly	5,825	5,440
Hampstead	3,840	3,140
District	9,899	8,930
Tramways	4,922	4,631
Total	£27,861	£25,261
Total to date, three weeks	84,825	76,629

KANSAS CITY RAILWAY AND LIGHT.

The report of the Kansas City Railway and Light Company for the month of December and seven months ended December 31 compares as follows:

	1908.	1907.
December, gross	$ 576,140	$ 512,666
Expenses	325,275	261,197
December, net	$ 250,865	$ 251,469
Charges and taxes	156,089	152,178
December surplus	$ 94,776	$ 99,291
Seven months, gross	3,808,779	3,678,738
Expenses	2,151,419	1,881,414
Seven months, net	$1,657,360	$1,797,324
Charges and taxes	1,087,341	1,076,743
Seven months, surplus	$ 570,019	$ 720,580

UNITED POWER AND TRANSPORTATION.

The income account of the United Power and Transportation Company for the year ended December 31, 1908, compares as follows:

	1908.	1907.
Inc. from securities owned	$688,284	$840,119
Expenses, taxes, interest, etc.	362,799	364,111
Surplus	$325,485	$476,008
Previous surplus	267,285	267,089
Total surp. applic. to divs.	$592,770	$743,097
Dividends		475,812
Profit and loss surplus	$592,770	$267,285

CHICAGO RAILWAYS COMPANY.

The Chicago Railways gross for November was $926,955, expenses $689,270, net $237,684. Figuring operating ratio at seventy per cent of gross earnings, and after deducting five per cent interest on valuation, the net income would be $124,336, of which the company's share is $55,951.

BROOKLYN RAPID TRANSIT.

The directors of the Brooklyn Rapid Transit Company declared on February 5 a dividend of four per cent, the first ever declared by the company. The dividend is payable April 1 to stockholders on March 10, and a resolution adopted by the board fixed the first days of April, July, October and January as the dates for the payments of such dividends as maybe declared in the future.

The company's gross earnings for the year ended June 30 last were $19,870,566, and its net income after the payment of taxes and fixed charges was $2,073,873, a decrease of $370,788 compared with the previous year. The need of fresh capital to provide for the demands for increased facilities has been one of the things which has kept back a dividend on Brooklyn Rapid Transit for several years. The recent financing of the road has been done largely through the issue of convertible bonds.

The directors organized by the election of the retiring officers with the exception of H. C. Du Val, who was third vice-president. This post was discontinued and Mr. Du Val was elected president of two subsidiary lines of the system. The executive committee elected consists of E. H. Harriman, Norman B. Ream, Anthony N. Brady, W. G. Oakman, J. Horace Harding, James N. Wallace and E. W. Winter.

The Public Service Commission has made public an abstract of the annual report of the constituent companies of the Brooklyn Rapid Transit Company for the year ended June 30, 1908. The Brooklyn Rapid Transit itself, not being an operating company, does not report to the commission. The figures showing operating expenses, operating revenue and surplus are as follows:

	Operating Revenue.	Operating Expenses.	Surplus.
Brooklyn Heights	$7,037,663	$4,565,096	$65,328
B'klyn Union Elev.	6,747,920	4,181,821	233,775
B'klyn, Q. & Sub.	1,759,352	1,063,290	863,360
C. I. & Gravesend	55,409	44,377	53,869
Nassau Electric	3,299,688	2,254,766	146,074
Seabeach Railway	264,905	214,385	*5,374
South B'klyn Ry.	301,202	347,248	*232,887

*Deficit.

The number of fare passengers for the Brooklyn Heights system was 131,525,523, while the elevated carried 129,305,365. The use of the transfer on the surface lines, however, is indicated by the total number of passengers carried: Brooklyn Heights, 211,638,391; elevated lines, 144,487,895. On the surface lines approximately 71,000,000 transfers were collected as against approximately 10,000,000 on the elevated trains.

During the year 120 persons were killed on the Brooklyn Rapid Transit Company system and 22,926 accidents.

DETROIT UNITED RAILWAYS.

The summary of the business of the Detroit United Railway, Rapid Railway, Sandwich, Windsor, and Ambersetring; Detroit, Monroe & Toledo Short Line, for the years ended December 31, 1908 and 1907 compare as follows. The figures for 1908 include also Detroit, Jackson & Chicago Railway, and in 1907 from February 1, 1907:

	1908.	1907.
Gross	$7,114,760	$7,073,245
Expenses and taxes	4,559,123	4,465,044
Net	$2,555,637	$2,608,201
Other income	64,956	60,505
Total	$2,620,593	$2,668,706
Interest on funded debt:		
Detroit Union Railway	$1,138,799	$1,106,548
Rapid Railway system	135,050	135,050
S. W. & Am.	23,785	18,000
D. M. & T. S. L.	122,131	121,700
Det., Jackson & Chi.	198,900	172,950
Total charges	$1,618,665	$1,554,248
Surplus	*1,001,928	1,114,458
Dividends		343,750
Balance	$1,001,928	$ 770,708
Depreciation and reserve	350,000	276,000
Net surplus	$ 651,928	$ 494,708

*Equal to eight per cent on the $12,005,000 capital stock. After charging out $350,000 for depreciation, the balance for dividends equals 5.2 per cent on the capital.

The company made liberal expenditures during the year in the maintenance of its tracks, rolling stock and other properties. On January 1, 1908, the depreciation reserve account stood credited with $526,000. Some heavy expenditures were incurred for extensive renewals of tracks and foundations, involving heavier construction to meet increased traffic conditions, a part of the cost of which, namely, $137,385, was charged against this depreciation reserve. There was added to the credit of the depreciation reserve during the year $300,000, leaving said fund with a present credit balance of $688,614. At the beginning of the year the company's surplus stood credited with $1,996,362. There has been credited to a contingent liability reserve the sum of $50,000 out of the earnings of the year 1908 and the sum of $150,000 out of the surplus above mentioned, leaving a present surplus of $2,491,164.

OTTAWA ELECTRIC.

The Ottawa Electric Railway (Canada) reports for the year ended December 31, 1908, compared as follows:

	1908.	1907.
Gross	$616,229	$574,278
Expenses	416,789	361,743
Net	$199,440	$212,535
Charges	39,038	31,626
Surplus	$160,402	$180,909
Dividends	146,819	119,484
Balance	$ 13,583	$ 61,425
Contingent charges	13,583	26,000
Surplus		$ 35,425

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

THE PROFESSIONAL ABILITY OF FIREMEN.

Attention has recently been called to the great improvement that may be obtained in the efficiency of firemen by instructing them in the manner of handling their fires and by controlling their work by a recording registering apparatus. The results of a contest of firemen held at the Liège Exposition give some interesting information in this respect. Eighty-three men took part in the contest. The production of steam in identical boilers per square metre of heating surface per hour varied from a minimum of 7.60 kilogrammes to a maximum of 16.40 kilogrammes, a difference of 115 per cent. The most interesting comparison is that of the amount of steam produced per kilogramme of dry coal, the results in this case being a minimum of 5.545 kilogrammes, a maximum of 8.502 kilogrammes, and a general average of 7.293 kilogrammes (water at naught degrees centigrade, steam at ten atmospheres). This shows that a good fireman can effect a saving of fifty-three per cent over one of mediocre ability, and of twenty-four per cent over the general average. The losses due to incomplete combustion varied from 29.31 per cent to 60.57 per cent of the amount of fuel used. It is evident that the ability of the fireman may bring about a considerable economy.—*Translated and abstracted from L'Electricien (Paris), January 9.*

A NOVEL PROCESS OF TELEPHOTOGRAPHY.

C. M. Senlecq of Ardres, France, in his system of telephotography, has utilized an ingenious mechanical principle. The conversion of luminous shades into variations of current intensity is effected without specially prepared plates immediately in the camera and does not entail any special manipulations. The light rays strike in the focus of the camera a slide covered at its front with a glass plate, and designed at its back as a microphone connected with the transmission line in the same way as the microphone of a telephone plate. The interval between the glass plate and the microphone is about one inch through. This space is filled with a mixture of hydrogen and chlorine gases prepared in the dark under a given pressure. The glass plate inside the camera is covered with a rotary screen, in which are a series of openings arranged in spiral lines. This is similar to the disc used by the inventor, but in this case the selenium specks are replaced by perforations. The accompanying illustrations give some idea of the mechanics of the device. In Fig. 1, F is a plate of an Ader microphone, the vibrations of which correspond to the light shades acting on the gas mixture. G, in Fig. 2, is a screen one metre or more in diameter, which, during each rotation, covers every portion

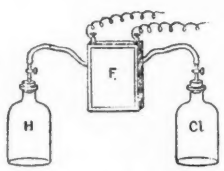


FIG. 1.—THE SENLECQ TRANSMITTER.

of the picture in a very close line. The two gases are contained in opaque receptacles, H and CL (Fig. 1). The conversion of the different light shades into fluctuations of current intensity takes place as follows: A mixture of equal parts of chlorine and hydrogen can be maintained only in perfect darkness. Under the action of even, diffused light a combination

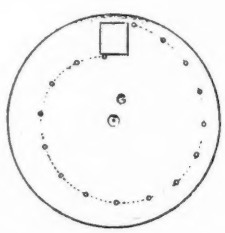


FIG. 2.—DISTRIBUTING DISC, USED WITH SENLECQ TRANSMITTER.

of the two gases to hydrochloric acid takes place at a rate corresponding to the variable luminous intensity. Experiments conducted by the inventor show the combination of the two gases in the camera always to occur instantaneously, exerting on the microphone plate an action identical to that of sound vibrations. The phenomenon, from being electrical, thus becomes a purely chemical effect, producing mechanical action. Vibrations of the microphone are in turn transmitted to the remote end of the line in the shape of electric fluctuations. Owing to its strong affinity for water, the hydrochloric acid is absorbed immediately after production. The transmitted currents may be used for reproducing a picture by means of any telephotographic apparatus. The inventor uses in this connection his telelectroscope and shade scale, which was described in Vol. LIII, page 515, of the ELECTRICAL REVIEW.—*Abstracted from the Electrical Review (London), January 15.*

FEATURES OF THE EXTENSIONS TO THE ST. PANCRAS GENERATING STATION.

Some interesting extensions have recently been made at the Kings Road generating station of the St. Pancras Borough Council in England. Four 2,000-kilowatt Parsons-Willans turbo-alternators will be installed, and one of the most interesting points in connection with the design of the building itself is the provision which has been made for ventilation. Elaborate care has also been given to obviating all possibility of sound or vibration being transmitted to the outside. The objects in view in designing the ventilator on the roof were to provide a free outlet to the heated air in a direct upward direction to the sky and at the same time afford complete protection from rain. The framework resembles a cooling tower in shape and is of steel, with sides and partitions of concrete reinforced with expanded metal. The air passes through the openings in the roof at each side and turns inward to the central chimney, which is open at the top and has no cover to deflect the sound. This chimney is divided into a number of cells, which prevent rain drifting at an angle from dropping through the openings into the engine room, and the under edges of the partitions are drained by gutters. The incoming air is drawn through a set of ducts under the engine-room floor from a special area covered with wire gauze. All the windows are double for the purpose of keeping the sound in, and duplicate roller shutters, both lined with felt, are provided at all doorways. The foundations for the generating sets are arranged according to the Prache system for avoiding trans-

mission of vibration. This is the first Willans turbine installation to be mounted on this form of foundation. The set itself is bolted to a block of concrete about two feet thick, reinforced with a steel grid and supported entirely by a series of circular rubber stools near its edges all around, which rest on the ordinary concrete foundation built into the ground. The top of the floating block is level with the engine-room floor, but the edges stand clear all around, so that there is no connection at all except through the rubber. A trench is provided all around, from which the rubber blocks may be inspected. Each rubber piece is a cylinder about four-and-one-quarter inches in diameter and three inches in height when compressed by the weight. They are all separately renewable and can be withdrawn and reinserted without difficulty by compressing them still further by tightening up the jacks in which they are held by screws.—*Abstracted from Electrical Engineering (London), January 14.*

THREE-WIRE SYSTEM FOR TRAMWAYS.

E. Goulding describes the adoption of the three-wire system which is working with excellent results on the City & South London Electric Railway's system. Taking a tramway four miles in length, of double track, with rails weighing 100 pounds per yard, four cars per mile, each car taking twenty-five amperes, and trolley wire of 000 S. W. G., the resistance per mile of double track is 0.012 ohm. The total current taken by the cars is 200 amperes. The drop in track, which is measured by the length times the resistance times the total current divided by two, gives a total of 4.8 volts drop. Using two trolley wires at double voltage, with the track as the neutral return, there is a saving of seventy-three per cent in the weight of copper over that required for a two-wire system. This high economy is to a great extent due to the fact that with the two-wire system the track is partly used as a means of return, and also that the length of return cable installed is larger than necessary to carry the current for the end section only. The second point claimed for the three-wire system is the small drop in the track; in fact, this drop is so small for comparatively heavy loads that no track feeders are necessary. Boosters and attendant gear are also eliminated. There is also a prevailing element of anxiety with the present system on account of electrolytic troubles, while with the small drop that takes place in track rails on the three-wire system the question of electrolysis could not occur. To obtain the full advantages of the three-wire system the load on both sides must be the same, when there will be no return or out-of-balance current through the track (or middle wire). The only duty of the track under such conditions is to act as a conductor between the cars on the opposite sides of the system, in which case the drop in volts on the track simply depends upon the distance between the cars. With the worst condition that could occur—that is, when one side becomes inoperative and the track has to act as a conductor to the working side—the total drop on track amounts to 4.8 volts. There is the necessity, of course, of careful study of local conditions to balance the load on the feeders in the way found most expedient. It is quite feasible to split up various sections of the trolley wire in such a manner that on a long, steep gradient or on a track with exceptionally heavy service, portions of the line may be alternately fed from the positive and negative sides of the system. There are two practical methods of balancing in the power house: One is to arrange the feeder panels and connections so as to allow a ready transfer of the feeders from the positive to the negative position, or vice versa, by means of double-throw switches. This means a certain amount of complication on the switchboard and a corresponding additional cost. There is an advantage, however, attached to the reversal of polarity on account of the improvement in the insulation of the negative. The other method is to balance by means of the generators, and this method presents the simplest solution. The entire separation of the poles, making it impossible to have 1,000 volts on one panel, removes any element of danger. The power-house plan and switch gear require no change in design, nor do the cars, motors, controllers or track. It is in the overhead equipment that alteration will have to be made. To prevent the possibility of anybody coming into contact with the two trolley wires at the same time the simple precaution of keeping the wires nine feet apart will suffice. The danger attendant on bringing two leads at a potential difference of 1,000 volts into one feeder pillar is overcome by using two pillars instead of one. In the installation described in this article special forms of insulators have been worked out.—*Abstracted from the Tramway and Railway World (London), January 7.*

RULES FOR THE EQUIPMENT OF ACCUMULATOR ROOMS.

The Accumulator Manufacturing Company of Berlin has recently published an interesting study giving rules for the equipment of accumulator rooms. The following are some of the principal recommendations made therein: The batteries should be installed in rooms in the vicinity of the machine hall which serve for no other purpose, are easily accessible, well lighted, dry, easy to air and not exposed to great variations of temperature. Dust, vapors, dangerous gases and violent jars in the room should be prevented. There should be no iron pipes or columns in the room, if possible, and if they are necessary they should be covered by an enamel lacquer which is not attacked by acids. For lighting, only incandescent lamps should be used. In order to maintain the batteries in good working order, only rooms in which the temperature is liable to fall extremely low should be heated, but never by an open fire. Stationary batteries, on account of their heavy weight, should be placed on solid beams. In cellars stamped ground covered by a layer of brick or cement is sufficient. If the ground is sandy a layer of concrete five centimetres thick should be put under the brick. A mixture of hot coal tar and asphalt should be poured into the cracks between the bricks after they have been filled up with fine sand to about one centimetre from the top. If the battery is to be installed above the cellar, a solid floor should be built in keeping with the weight of the battery and capable of preventing any spilt acid from penetrating into the rooms below. The floor should be perfectly level and well protected against the destructive action of the acid. The walls, ceiling, electric conductors and iron parts should be covered by an enamel lacquer that is not attacked by acid and does not contain alcohol. Cement-covered walls must be perfectly dry before being painted, as otherwise the paint will peel off. If the accumulator room is directly under the roof of a building a false ceiling should be erected to prevent any water condensing under the roof from falling into the batteries. The rooms should be painted before the installation of the batteries, or at any rate before filling and charging them, as these operations make the walls damp. Facilities should be provided for airing the rooms well, especially when the charging of the batteries approaches completion.—*Translated and abstracted from L'Electricien (Paris), January 9.*

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

American Supply and Machinery Manufacturers' Association.

Believing that the time is ripe for a firm and determined stand on the three vital questions that confront manufacturers in this country today, viz., unfair competition, quality maintenance and profit protection, the American Supply and Machinery Manufacturers' Association, in a declaration of principles recently issued, declares itself opposed to unfair competition, which strikes at the wage-earner, often compelling reduction in costs of production at the expense of labor. Such competition menaces the dealer by depriving him of the legitimate profits to which he is entitled. It increases expenses of operation and production to the consumer by forcing down the qualities of goods marketed. Its effect on manufacture is to compel a changing basis of qualities to meet price conditions, sacrificing reputations to demands thus unjustly created.

The Association therefore favors such changes in the bankruptcy laws or other legislation as will tend to discourage and prevent disastrous competition caused by the inexperienced or unprincipled manufacturer who fails to provide for his actual manufacturing costs, or to allow for a reasonable margin of profits in making his prices, thereby bringing ultimate failure upon himself, hardship upon his employes and loss upon other manufacturers in his line and the public in general. These and other classes of unfair competition are the stepping stones to fraud, fire and failures.

The members of the Association have resolved, when ordering supplies through their respective dealers, to give preference to the highest qualities of goods manufactured by members of the Association, declaring themselves unalterably opposed to the substitution of inferior goods as first qualities, either by manufacturer or dealer. They also oppose the practice of the manufacture of inferior goods under private brands that can be marketed to the prejudice of other makers' first-quality goods. Endorsement is made of the policy of promotion by the manufacturers of the value of trade-marks, brands and other recognized means of securing identification of products, thus affording protection alike to the user, the distributer and the manufacturer.

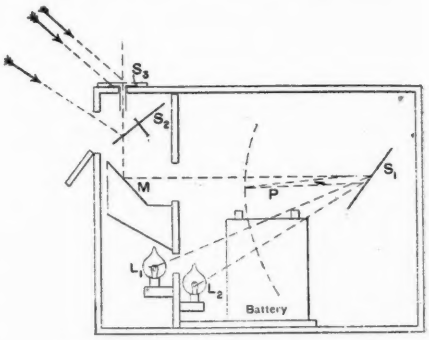
The manufacturers of the Association encourage the sale of their product to the consumer on the basis of proper resale prices, insisting upon such prices where goods are sold by makers or their representatives direct and offering every encouragement to the dealer for co-operative action in carrying out this policy. They unite to discourage the obtaining of unfair profits by selling certain classes of goods at prices carrying more than reasonable profits in order that other classes may be sold at prices that carry no profit, thus preventing honest and healthy competition.

The proper resale price, they believe, can only be established by the most careful consideration of each line of goods, and arrived at by joint conferences on the part of the makers of such goods and the dealers therein.

The membership of the American Supply and Machinery Manufacturers' Association comprises 160 large manufacturing companies, engaged in various lines of production, in all parts of the country. The officers of the Association are: President, Charles F. Aaron, New York Leather Belting Company, New York, N. Y.; Vice-presidents, L. D. May, A. Leschen & Sons Rope Company, St. Louis, Mo., E. H. Hargrave, The Cincinnati Tool Company, Cincinnati, O., J. W. Gardner, The Gardner Governor Company, Quincy, Ill.; secretary-treasurer, F. D. Mitchell, 309 Broadway, New York, N. Y.

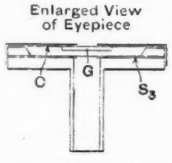
The Harrison Universal Photometer.

The latest form of the Harrison universal photometer, manufactured by Elliott Brothers, 101 St. Martin's Lane, London, Eng., has recently been considerably improved by the addition of a simple attachment that enables the horizontal illumination from all sources to be measured. The instrument, says *Electrical Engineering,* is intended for the measurement of illumination on a screen making an angle of forty-five degrees with the vertical, and for the measurement of the candlepower of various sources of light. It is provided with a flicker disc rotated by a blast of air under the control of the operator. By fixing the flicker disc to half cover the field of view of the eye-piece, the instrument may be used as a direct-comparison photometer, the illumination of the source of light being compared directly with that of the adjustable screen inside the instrument, illuminated by a small standard lamp connected to a self-contained accumulator battery.



IMPROVED FORM OF HARRISON PHOTOMETER.

The recent addition to the instrument consists of a horizontal screen, which is covered by a cap when the flicker disc is used. This cap has a hole through the centre, and forms the eye-piece of the instrument. When the cap is removed the horizontal screen is exposed, and by fixing the flicker disc out of the field of view



EYE-PIECE OF IMPROVED HARRISON PHOTOMETER.

of the eye-piece, by means of a small milled-headed screw, the photometer can be used to measure horizontal illumination by direct comparison. The accompanying figure gives a general diagram of the instrument, together with an enlarged view of the eye-piece, which will make the construction quite clear.

The illumination to be measured is in all cases read off directly on the scale by means of the pointer, which is fixed to the adjustable screen mentioned above, and by moving which a balance is ob-

tained between the illumination of the source of light under test and that due to the small standard lamps inside the instrument.

From the foregoing it will be seen that the following tests can be made with the instrument: Candlepower by means of flicker disc; candlepower by direct-comparison method; illumination on screen at an angle of forty-five degrees by flicker disc; illumination on screen at an angle of forty-five degrees by direct-comparison method; horizontal illumination by direct comparison.

The accompanying references apply to the illustrations: S_1. Adjustable screen, attached to pointer. P. Pointer on outside of case. S_2. Revolving sector screen for general illumination. S_3. Screen for horizontal illumination. M. Reflecting mirror. L_1, L_2. Standard lamps. C. Cover cap, to be removed when taking horizontal illumination. G. Glass in eye-piece.

The original features of the instrument have all been retained, and the new model is just as simple to manipulate as the older pattern, and among advantages possessed by the instrument are light weight and portability, and long range due to use of two standard lamps of different candlepowers. Permanent connections are made between battery and rest of circuit, which need never be disconnected for charging purposes, and the battery, standard lamps and flicker disc may be readily removed from instrument for inspection, without disconnecting or altering any adjustments. Easy and accurate manipulation is secured, due to arrangement of pointer screen and flicker disc. We may mention that the addition of the horizontal attachment does not increase the cost of the instrument, owing to its simple construction and method of manufacture.

A Motor-Driven Table Saw.

A tool for woodworking establishments which is to be especially commended on account of its convenience, efficiency and neatness is the motor-driven table saw manufactured by the Crescent Machine Company, Leetonia, Ohio, illustrated herewith.

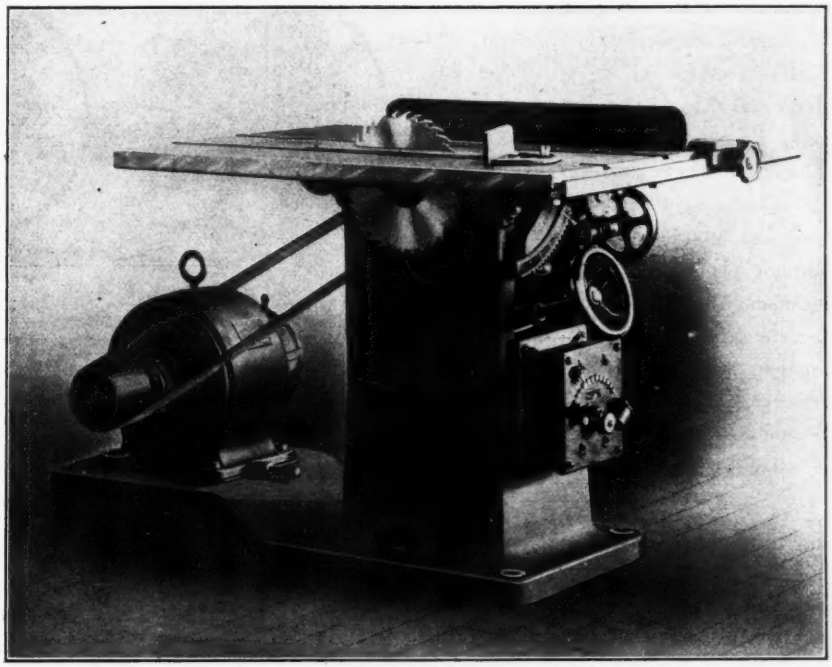
The saw table proper and the saw itself are supported upon a pedestal which also furnishes a frame upon which the mechanism for adjusting the saw and table and the starting rheostat are mounted.

This adjusting mechanism consists of means for tilting the table and raising or lowering the saw. The former is accomplished by means of a handwheel whose shaft bears a worm, with a graduated brass scale and pointer to show exactly the amount the table is tilted, up to forty-five degrees. By means of the other handwheel the saw is adjustable in a vertical direction, making the machine adapted for cutting boards of different thicknesses up to four inches. The saw itself may be as large as fourteen inches, but no larger.

The motor equipment consists of a three-and-three-quarter horsepower totally-enclosed Westinghouse type R motor and a starting rheostat. It is a shunt-wound, direct-current motor, running at a constant speed of 1,800 revolutions per minute, on a line voltage of 220 volts. The type D rheostat is equipped with an automatic low-voltage release and is used for starting only.

The motor is mounted on the extended base of the saw table proper. It is belt-connected to the saw mandrel at the back of the pedestal.

A reference to the illustration shows the extreme ease of operation brought about by the motor equipment. The five operating handles are all within a radius of about one foot. The table can be tilted, the saw raised or lowered, the ripping and cut-off fences adjusted and the saw started or stopped without the operator moving a step. The motor is behind the machine out of the way, and takes up no space that would otherwise be useful, being beneath the overhanging table. The machine can be located in any position desired, being independent of line shafts. The minimum amount of power is wasted, nothing being consumed by extra belts, countershafts, etc. It should be further noted that a saw of this kind only operates intermittently and the absence of a main shaft and countershaft is thus particularly advantageous, since power is only used when work is actually being done.



MOTOR-DRIVEN TABLE SAW.

The Manufacture of Nippers and Pliers.

Nippers and pliers, or tongs, as they were called in early days, are used by the lineman, the electrician, the automobilist, the householder and workers in a great number of trades. In fact, no other tool is quite so handy as a nipper or plier for cutting or holding a piece of work. To make the pieces, joint them and rivet them together is a difficult operation, requiring great skill and ingenuity, in order to make perfect tools. The Utica Drop Forge and Tool Company, of Utica, N. Y., has a new plant, which is the largest of its kind in the world devoted to this kind of manufacture. An acre of floor space is included under one roof, and the plant, which is constructed on modern lines, contains a mile of railway, operated by an electric locomotive, for the distribution of its product from one department to another. The product of the factory is inspected eight times during the passage of the tool through the mill, and each tool is tested before being sent to the customer.

Electric Fans for 1909.

As the season approaches when the demand for electric fans again becomes brisk, it is desirable to make a general survey of the field so as to find what new types are being offered by the makers among their 1909 models. The popularity of the oscillating fan in distributing its cooling breezes over a wide area has resulted in bringing forth several new types in this class. Another new line that seems to have filled a want in many installations is the column fan. In every class of electric fan there is a noticeable increase in the number of sizes of fans and a steady improvement in their ruggedness of constructive features, all of which can but enlarge the field of this device and make it a still more serviceable adjunct of our homes and places of business. The smaller fans, such as eight and nine-inch, in both direct and alternating-current types, are finding a place in an increasing number of residences, while the application of electric fans for clearing the atmosphere in telephone booths, railroad cars, staterooms, etc., is continually growing in importance. Among the offerings for 1909 the following are to be noted:

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.

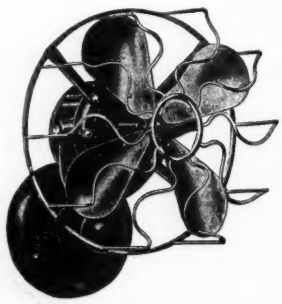
The Westinghouse Electric and Manufacturing Company's fans for 1909 include numerous types and sizes adapted to all kinds of commercial circuits and to any class of service to which fan motors may be applied. In addition to the standard lines of fans listed last season, several new models are this year presented, which have met with an enthusiastic reception, including eight-inch desk fans, telephone-booth fans, ventilating and oscillating fans.

The direct-current fan motors are characterized by lightness in weight, noiselessness in operation and high efficiency. The frames are cylindrical, made of cast-iron, and have rectangular pole-pieces and field coils. The armature is of the drum type, built up of laminated sheet steel mounted upon a carefully ground tool-steel shaft. Especial care has been used in the design of the commutator so that all commutating troubles have been entirely eliminated. The ceiling and column fan motors are provided with noiseless ball bearings to carry the weight of the moving part and the friction is reduced to an almost inappreciable amount.

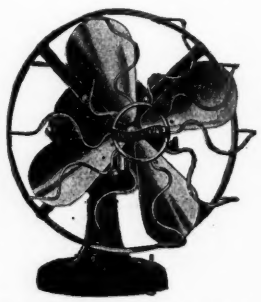
The alternating-current fan motors are of the induction type, except the eight-inch and telephone-booth fans, which have series windings. The frames are well ventilated and the stators and rotors are built up of specially annealed sheet-steel laminations. The shaft is of hardened tool-steel running in bushings of the best bearing metal, and the bearings are self-oiling with automatic oil returns to prevent oil-throwing.

The eight-inch desk and telephone booth fans are designed to run with absolute quietness and to furnish a moderate circulation of air for bedchambers and other places where the strong breeze from the larger fans would be objectionable. A switch is placed in the base of the motor by means of which it is started and stopped or given three speds. The telephone-booth fan is adjustable in both the horizontal and vertical planes and suspended by springs to dampen any vibrations which might affect the telephone. The current required to operate these fans is only about one-third of that consumed by an ordinary sixteen-candlepower lamp.

The ceiling and column fans have four blades set at the proper angle to obtain the greatest movement of the air with the least possible consumption of current. A number of tapped holes directly under the fan blades are provided to accommodate standard nipples or arms for electric-light fitting; either two, three, four, five, six, ten or twelve lights may be so used. The lamps are thus below the blades, so that the latter cast no shadows on articles below. The current consumption of the

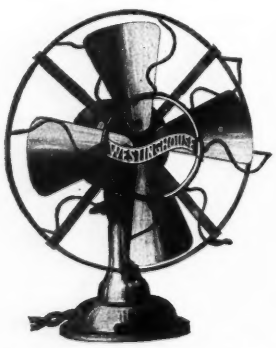


WESTINGHOUSE DIRECT-CURRENT BRACKET FAN.

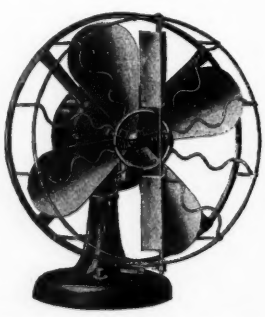


WESTINGHOUSE ALTERNATING-CURRENT DESK FAN.

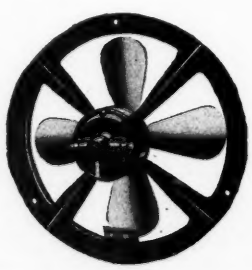
WESTINGHOUSE EIGHT-INCH TELEPHONE-BOOTH FAN.



WESTINGHOUSE EIGHT-INCH RESIDENCE FAN.



WESTINGHOUSE ALTERNATING-CURRENT OSCILLATING FAN.



WESTINGHOUSE VENTILATING FAN.

motor is less than that required for three standard sixteen-candlepower lamps.

The ventilating fans differ from the desk and bracket fans in the method of mounting employed. They are designed

WESTINGHOUSE ALTERNATING-CURRENT COUNTER-COLUMN FAN.

to act as exhaust fans for the ventilation of rooms and enclosures and consist of twelve-inch and sixteen-inch fan motors supported on ring frames suitable for mounting in wall openings. These fans are well adapted to draw off vitiated or

WESTINGHOUSE ALTERNATING-CURRENT FLOOR-COLUMN FAN.

heated air and this makes their use in kitchens, toilet rooms, chemical laboratories, etc., advantageous.

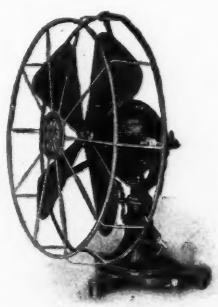
For places where it is desired to disperse the breeze from an electric fan over a wide area the Westinghouse company

WESTINGHOUSE ALTERNATING-CURRENT CEILING FAN.

is introducing an oscillating fan which is positive in action and of very simple construction. The oscillating device used on these fans is certain in its action and requires a small amount of energy. A vertical rod free to revolve through a quarter revolution is supported in front of the fan guard, and to this rod are fastened two pairs of auxiliary blades, each pair consisting of two blades set at right angles to each other. To the bottom of the vertical rod is connected a short lever, which, as the fan oscillates, strikes cushioned stops fixed on the base of the fan at any desired point, thus turning the rod with its blades through a quarter revolution at the end of each oscillation. The turning of the rod throws the auxiliary blades alternately parallel to the fan blades, first on one side and then on the other side of the centre of the fan, and the reaction of the air upon the auxiliary blades causes the fan to turn alternately from side to side. The body of the fan is supported on ball bearings so that it revolves freely on the slightest impulse. One valuable feature which eliminates any chance of accident from twisted leads is the transmission of the current from the base to the oscillator by means of brushes and collector rings.

WESTERN ELECTRIC COMPANY.

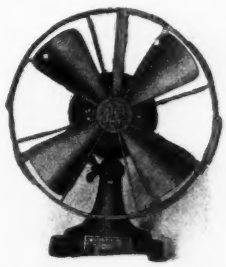
For the season of 1909 the Western Electric Company offers a comprehensive line of fan motors and ventilating outfits, a line that includes types to fully meet all demands for this class of apparatus. The greater number of these fans have been on the market for years and through constant improvement have been brought to a practically perfect state of design. Some slight changes, however, have been made from 1908 models directed toward still greater efficiency, and such new types have been added as seem justified by popular demand. Desk, bracket, oscillating,



WESTERN ELECTRIC "HAWTHORN" UNIVERSAL AS A DESK FAN.

ceiling, telephone-booth and exhaust fans are offered in a wide range of designs and in both direct and alternating-current types.

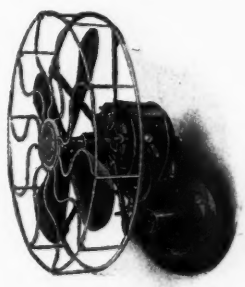
An attractive appearing and justly popular direct-current fan is the "Universal," this being a combined desk and bracket type, the change from one to the other being made by means of a thumb-screw. It is manufactured in two sizes, twelve-



WESTERN ELECTRIC EIGHT-INCH "HAWTHORN."

inch and sixteen-inch. The motor is totally enclosed and is fitted with an improved oil thrower which absolutely prevents oil reaching the field or commutator. The fan operates at three speeds and on 110 and 220 volts.

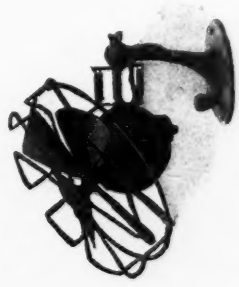
The "Zero" is an open-field direct-cur-



WESTERN ELECTRIC "VICTOR" AS A BRACKET FAN.

rent type and operates on 110, 220 or 500 volts. It has three speeds and is manufactured in twelve-inch and sixteen-inch sizes.

The "Victor" is a combined desk and



WESTERN ELECTRIC TELEPHONE-BOOTH FAN.

bracket alternating-current type, of neat and compact design. It is made in twelve-inch and sixteen-inch sizes and for operation on 110 or 220 volts. These fans are furnished for all commercial frequencies,

the range being from twenty-five to 133 cycles.

The "Victor" oscillating fan motor is of very simple construction and its operation is highly satisfactory. Both the

WESTERN ELECTRIC EXHAUST FAN FITTED WITH TYPE "E" MOTOR.

direct and alternating-current types are made for circuits of 110 and 220 volts.

The eight-inch "Hawthorn" is a new combined desk and bracket fan and is furnished for both direct and alternating-current use. It is a three-speed fan which is highly desirable for residential use as well as in small offices. The current consumption of this fan is very low.

Another eight-inch type manufactured by the company is the telephone-booth spring-suspension fan motor. This model has been greatly improved over the 1908 design. In addition to being used in telephone booths this fan is extensively used for mounting on light partitions, since the spring suspension eliminates vibration. It is furnished for direct and alternating current.

The line of ceiling fans includes a num-

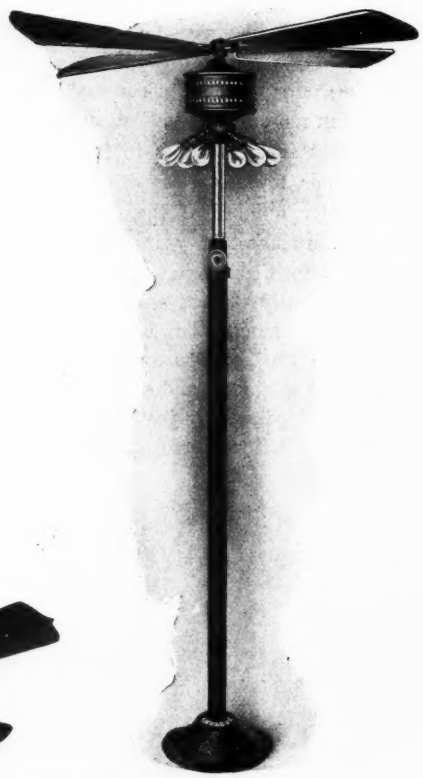
WESTERN ELECTRIC "STANDARD" CEILING FAN.

ber of plain and highly finished types for direct and alternating current. The Western Electric "Standard" is furnished to meet demands for a highly ornamental direct-current fan. The "Western" is furnished in plain or ornamental design, one or three speeds. All these fans are finished to operate on 110, 220 or 500 volts. The "Victor" for alternating current is furnished plain or ornamental, the former in two and the latter in three speeds.

A feature that makes the Western Electric Company's exhaust fans so highly satisfactory from the standpoint of reliable service and economy in operation is that the different fans ars equipped with motors best adapted to that particular style. Thus the "I" type motor is used on fans ranging in size from eighteen to thirty-six inches, while the "E" type motor is used on all larger sizes. Fans for use on alternating-current circuits are fitted with the "CS" type induction motor.

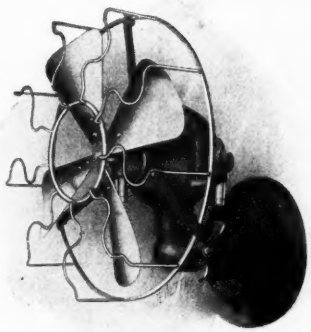
SPRAGUE ELECTRIC COMPANY.

In addition to the well-known twelve and sixteen-inch Lundell fans, the Sprague Electric Company, of New York, is introducing this season a new type of oscillating fan which is claimed to have many superior features. This new type



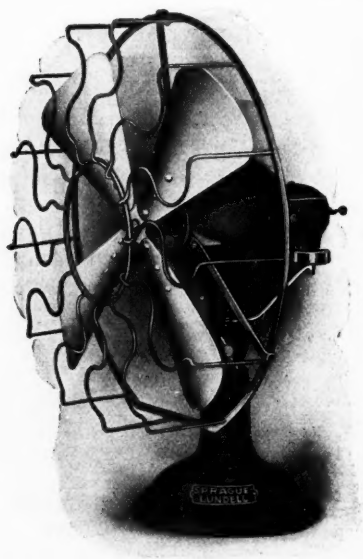
SPRAGUE DIRECT-CURRENT TYPE "T" COLUMN FAN.

of fan embodies all the essential features of the Lundell single field-coil fan, with the addition of an oscillating mechanism, which is extremely durable on account of its substantial and simple design of construction. No small gears are used, and ample lubrication is provided. The oscillating movement can be acquired or stopped by a simple turn of the lever locked on the casing at the back of the motor. In designing the Sprague oscil-



SPRAGUE-LUNDELL UNIVERSAL JOINT DESK AND BRACKET FAN.

lating fan with a view to simplicity and durability, nothing has been sacrificed in the degree of oscillation, and the downward pitch of the fan blades. The oscillating movement afforded in the desk or bracket fan is approximately 100 degrees; while the deflection downward as a desk fan is approximately twenty-five degrees, in the bracket fan it is approximately 100 degrees. This fan is made in the twelve and sixteen-inch sizes. An important



SPRAGUE-LUNDELL OSCILLATING DESK AND BRACKET FAN.

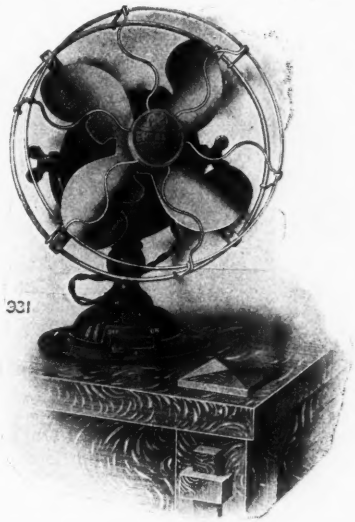
feature is the fact that the oscillating mechanism can be furnished and readily adapted to non-oscillating Sprague-Lundell twelve and sixteen-inch 1909-type fans.

The Sprague Electric Company is also

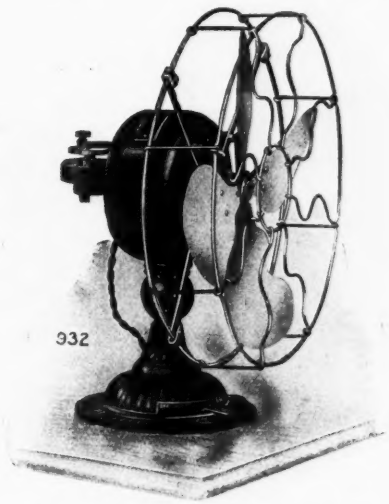
placing on the market this season, in addition to its Type T ceiling fans, attractive floor and counter-column fans in both plain and ornamental types. These fans, like the ceiling fans, have four blades, eight inches wide, with fifty-six inches sweep. The blades are of polished whitewood, firmly riveted to the holder, which in turn is screwed and locked to the fan spider. The field casting is of soft steel, with poles having projecting horns to retain the field coil. The armature core is built with notched punchings of specially annealed steel keyed to the shaft, the assembled core being held lengthwise by improved retaining rings. A liberal number of segments are provided in the commutator. Steel end rings with insulation are placed on a tubular shell, and the ends of the shell are upset over the rings. The whole when assembled makes a solid commutator and insures against high bars and defective insulation. The method of lubrication is adequate and overcomes the possibility of oil drippings. Brush-holders are held in the lower bracket, and have pencil-type carbon brushes with compression springs, all thoroughly insulated from the bracket by hard-rubber tubes. These floor and counter-column fans, like the ceiling fans, have been designed with a view of making them efficient, durable and attractive in appearance.

EMERSON ELECTRIC MANUFACTURING COMPANY.

To its already large assortment of induction-motor fans the Emerson Electric Manufacturing Company, of St. Louis and New York, has added for the coming season new types of eight-inch and oscillating desk fans, as well as desk and ceiling fans for twenty-five, thirty and forty cycles. All the desk fans are provided with a convertible bracket base, permitting ready change to the bracket type. The Emerson desk fans are also equipped with the Parker noiseless blade and hardened steel shaft. The ceiling fans are made for either two or three speeds. Column fans are made on the same lines as the ceiling fans. All the alternating-current fans have squirrel-cage induction motors carefully designed for economical operation; a twelve-inch, sixty-cycle fan blows an exceptionally strong breeze with a consumption of from forty-five to fifty watts. The motors are provided with special phase-splitting starting coils; these quickly bring the motor up to speed and are automatically disconnected. The new eight-inch desk fan has been produced along as economical and durable lines as the larger sizes and is sufficiently light to be carried about easily.



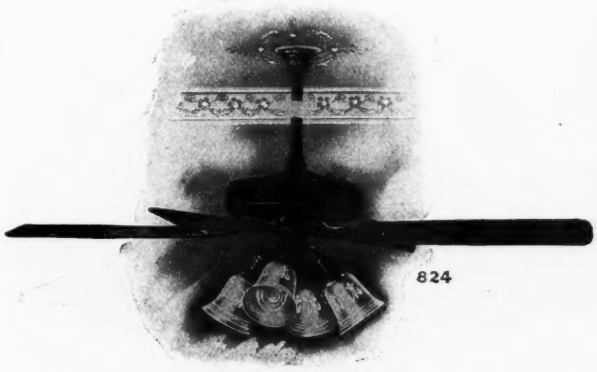
EMERSON EIGHT-INCH DESK FAN.



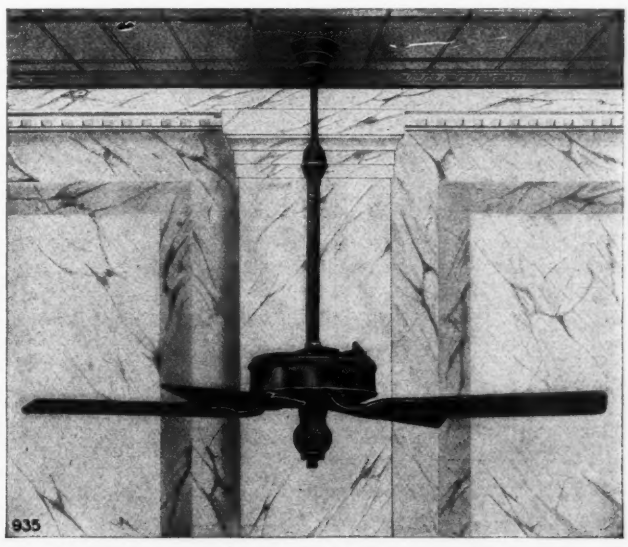
EMERSON OSCILLATING DESK OR BRACKET FAN.

Emerson oscillators have a special convertible bracket base and may be changed into adjustable oscillating bracket fans without extra parts. The oscillating or lateral swinging movement is secured by a worm gear attached to the rear end of the shaft, operating an adjustable lever arm, which swings the fan gently from side to side. The oscillating device is positive in its action and operates with the fan in any position, as a desk or bracket fan. With this device the fan need not be set on an absolutely level surface, as is the case with wind-operated oscillators. The breeze is not obstructed and the fan oscillates perfectly, whether the blades are tilted upward or depressed to throw the breeze down, as is often desirable.

Among the new ceiling fans is one for forty cycles, having four blades with a fifty-two-inch sweep. It has three speeds:



TROJAN CEILING FAN.



EMERSON FOUR-BLADE FORTY-CYCLE CEILING FAN.

100, 125 and 150 revolutions per minute and consumes 130 watts as a maximum. These speeds are controlled by an indicating snap-switch. All ceiling fans made by this company are wired for lights independently of the motor circuit, so that it is not necessary to order special electrolier fans or special parts from the factory. To meet the demand for a lower price fan, the company also produces the Trojan fan, which is somewhat plainer in finish and has but two speeds. A full line of both Emerson and Trojan column fans is also made.

DIEHL MANUFACTURING COMPANY.

The Diehl Manufacturing Company, Elizabethport, N. J., will place on the market for 1909 practically the same line of fan motors as was shown a year ago. A new fan with eight-inch blades will replace the earlier nine-inch type.

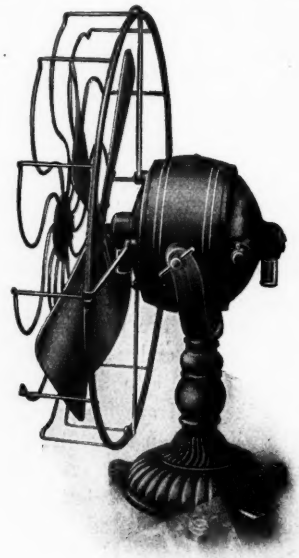
Diehl Universal fans combine in one unit the desk, trunnion and bracket types. The trunnion turns on a seat milled on the upper half of a ball, the movement being nearly a complete circle, limited only by a set-screw, which acts as a stop. These fans are equipped with a speed regulator, the resistance of which is composed of wire wound upon plates of pure mica. The switch base is of glazed porcelain, heavily ribbed.

The Diehl telephone-booth fan is spring-suspended, absolutely noiseless, and free from vibration.

The Diehl oscillator fan is similar to the Universal fans, and can be adjusted in any manner for desk or bracket use. The oscillator fans are made in two sizes, with twelve and sixteen-inch blades, and provided with regulators giving the usual three speeds.

The Diehl ceiling fans are well known and especially attractive. The No. 44 fan is of the ironclad type, with four blades carried by iron blade-holders finished in polished nickel. The covers are ornamental castings, and the body is covered by a band finely finished in japan, beaded, and with gold stripes. The No. 45 fan is of the same general construction as the No. 44. The switch tube is provided with cable with extra wires, and the switch-holder is drilled, so that this fan may be readily changed to an electrolier fan by adding light brackets and making connections. The No. 46 electrolier fan has the same features of construction as No. 44 and No. 45. The light brackets are of sufficient length to give the lights proper angle and spread. This fan is also furnished with four Nyssa-wood blades.

DIEHL TWELVE-INCH OSCILLATOR DESK FAN.



DIEHL UNIVERSAL DESK AND BRACKET FAN.

DIEHL NO. 13 STANDARD CEILING FAN.

DIEHL NO. 45 CEILING FAN.

No. 13 is the Diehl standard ceiling fan. This is a two-blade fan, and may be furnished with a three-speed regulator by removing the basket. No. 16 is an electrolier fan similar in design to No. 13, with the light brackets added. This fan has a detachable basket, which may be unscrewed from the fan without disturbing any wires. No. 17 is a particularly handsome fan, its trimmings being of spun-brass ornamented with open cast-brass work of elegant design. No. 18 is similar to No. 17, but without electrolier attachment.

The Diehl line is completed by a column fan, which is used extensively where it is impracticable to hang ceiling fans. The base is a solid casting finished to match the upper half of the standard, basket and corona. The lower half of the standard is marbleized. The upper part is of heavy brass tubing, and an iron pipe extends through the centre of both, insuring a rigid and substantial outfit.

The electrolier column fan is of the

same general construction and the trimmings are the same as on the No. 16 electrolier fan.

These ceiling fans are made for 110, 170, 220, 250 and 500 volts.

CROCKER-WHEELER COMPANY.

The ventilating fans of the Crocker-Wheeler Company, Ampere, N. J., are now used for ventilating offices, stores, schools, factories, churches and all kinds of buildings, both public and private; also in connection with steam-heating systems, for the heating of factories and buildings and in the drying of lumber, hides, textiles and other materials. In any branch of manufacture, they are of great value where the removal of moisture by the movement of large quantities of air at low pressure is required; in laboratories and chemical works they are

CROCKER-WHEELER VENTILATING FAN.

employed for withdrawing noxious fumes and gases.

These fans consist of Crocker-Wheeler Form "L" motors direct-connected by substantial arms to the wall ring and carrying on the armature shaft a propeller type of fan of the latest design.

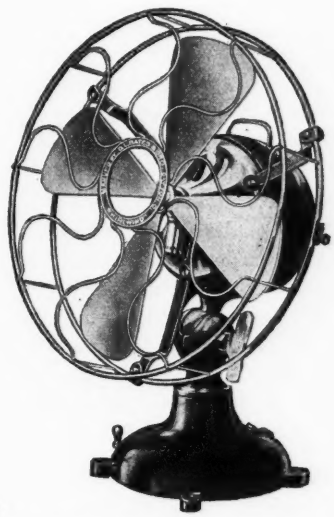
They may be attached to the wall or ventilating duct, and may be furnished for operating in a vertical position.

Stock sizes of these fans are eighteen inches, twenty-four inches, thirty inches and thirty-six inches. Larger sizes can be furnished on special order.

The motors are generally of the open type, but when the fan is to operate in a moist or dusty atmosphere, enclosing covers are supplied.

D. L. BATES & BROTHERS COMPANY.

One of the oldest manufacturers of electric fans is the D. L. Bates & Brothers Company of Dayton, Ohio, that for eighteen years has been making a specialty of direct-current fans. Among the well-known ceiling fans made by this firm are the Style E fan for any voltage from 110 to 500, the Imperial three-speed fan for 110 or 220 volts, and the revolving-electrolier fan. The latter has been found a very attractive fixture, especially if colored lamps are used. The lights revolve with the blades. Their wiring is entirely distinct from the motor circuits, so that the lamps may be turned on or off without stopping the fan. Very attractive column fans are made with or without electroliers. In the way of desk fans, three sizes—twelve, sixteen and twenty-inch universal fans are made. These can be used as desk, trunnion or wall-bracket fans without the use of extra attachments. The universal joint can be set to throw the air in any direction.



BATES UNIVERSAL FAN.

THE ECK DYNAMO AND MOTOR COMPANY.

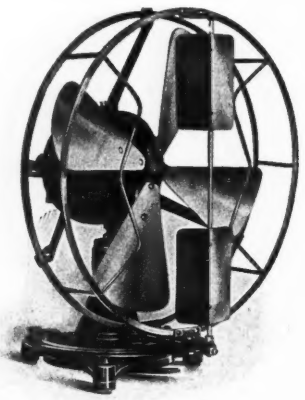
The "Eck Hurricane" oscillating fans are made for direct current by the Eck Dynamo and Motor Company, Belleville, N. J. The accompanying illustration shows one of the convenient positions in which the "Eck Hurricane" oscillating fans may be used, the fan being located at any height on the wall and adjusted to blow the air downward and also to oscillate from side to side. It may be used at such height when placed on a shelf. "Eck Hurricane" Universal fans are made with an adjustable ball joint which allows them to be tipped forward at an angle of fifteen degrees from the horizontal position and also to be used as wall fans. They can be thrown back to a right angle with the base or used in any intermediate position. They can also be turned to either side of the centre and secured in position by a thumb-screw.

"ECK HURRICANE" OSCILLATING FAN.

BATES REVOLVING-ELECTROLIER CEILING FAN.

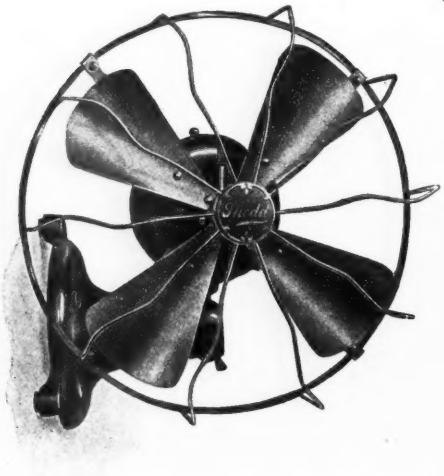
SHEDD ELECTRIC COMPANY.

A complete line of direct-current and alternating-current fans has been prepared by the Shedd Electric Company, of Roselle, N. J. All the alternating-current fans are provided with induction motors of any desired frequency or voltage. The



THE NEW SHEDD OSCILLATING FAN.

new universal fan has a marked feature in that it can be used with practically an unlimited scope of adjustment as either a desk fan or as a wall fan. It is constructed with a single ball-and-socket joint with only one set-screw, thus permitting rapid and unhampered adjustment. The oscillating fan shown in the accompanying illustration is the result of several years' experience in the production of this

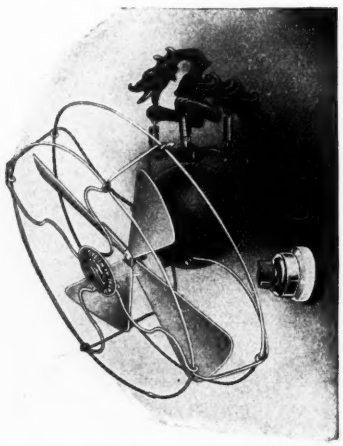


SHEDD UNIVERSAL FAN, BRACKET VIEW.

class of fans. The company believes it to be the most simple, substantial and successful oscillating fan yet manufactured. The guard and oscillating device are of new and approved design, the most important feature being in the fact that there is practically no dead centre in the reversing mechanism. The oscillation is caused by a rectangular blade, so operated as to change its position almost instantaneously, thereby causing the fan to change its direction without the hesitation common to most types of wind-operated oscillating fans. The extended reversing arms of the previous model have been discontinued and replaced by reversing springs in the quadrant. The outstanding reversing arm has also been replaced by one extending back under the fan guard, making the complete mechanism more compact and effective, controlling the oscillation perfectly, and causing the fan to oscillate satisfactorily when mounted to a considerable degree off level. The oil return, which has been incorporated in the end plates of the motors at the bearings, overcomes all throwing of oil from the bearings, thus obviating the liability of soiling any article which may be in close proximity to the fan when in operation.

FORT WAYNE ELECTRIC WORKS.

The Fort Wayne fan motors for 1909 will be a rather more complete line than has been shown heretofore. The company will list its usual eight-inch desk fan, both alternating and direct current; also the eight-inch Universal bracket fan, both alternating and direct current. This is a standard motor body with a brass gooseneck bracket fastened to it and held by a lug mounted on the wall. The fan

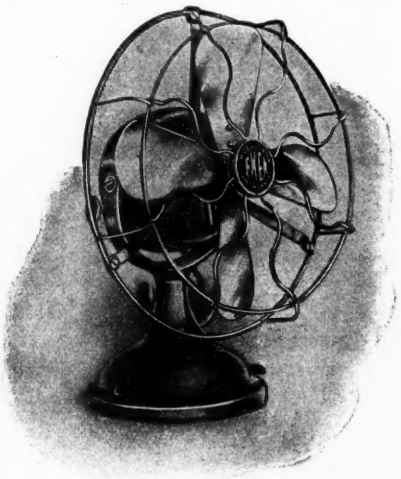


FORT WAYNE EIGHT-INCH TELEPHONE-BOOTH FAN.

is adjustable vertically and horizontally.

The eight-inch revolving fan motor is practically the same as in previous years. This motor is adapted to be hung from an ordinary lamp socket and revolves horizontally around its support, thus throwing air to all parts of the room.

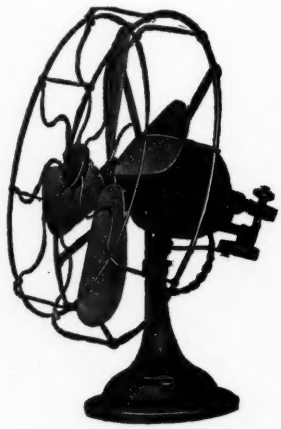
The eight-inch telephone-booth fan motor is adapted to telephone booths, as it is small, light-running, noiseless and of somewhat slower speed than the ordinary type fan motor.



FORT WAYNE TWELVE-INCH SWIVEL AND TRUNNION DESK AND WALL-BRACKET FAN.

In addition to these the company will also have a swivel and trunnion fan motor in both twelve and sixteen-inch sizes for alternating current. This fan may be used as a desk fan or as a wall-bracket fan. There is also a twelve and a sixteen-inch desk and wall-bracket direct-current fan which, while not being a trunnion fan, may be used for either desk or wall service.

A new line of oscillating fan motors for both alternating and direct current in the

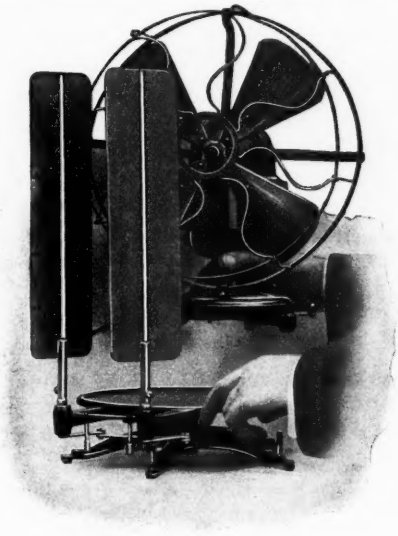


FORT WAYNE TWELVE-INCH OSCILLATING DESK AND WALL-BRACKET FAN.

twelve and sixteen-inch sizes has been added. The peculiar feature of these fans is their automatic swinging in a horizontal direction within an angle of ninety degrees. This fan may be used as a desk or bracket-fan motor, the oscillating feature being perfectly adapted for either use.

SIMPLEX MANUFACTURING COMPANY.

The advantages of oscillating fans have been amply demonstrated since this popular improvement in construction was brought out several years ago. The oscillating fan avoids a direct continuous draft whose steady application is often uncomfortable and may prove unhealthful; while distributing the current of air throughout the room, it takes the place of



SIMPLEX OSCILLATOR.

several other stationary fans which would be required to furnish an equivalent general and refreshing air-movement.

With all these obvious advantages one obstacle in the introduction of the oscillating fan has been its expense, especially when it is undertaken to supplant a stationary fan already owned, for which little credit will be given as a second-hand value. With the absurdly small amount commonly allowed for a perfectly good stationary fan capable of many more years of service, it is not surprising that whatever the advantage of the oscillating fan in making new sales, it is very slow to supplant stationary fans in service.

A device to convert any fan into an oscillating fan has been introduced by the Simplex Manufacturing Company, 90 West Street, New York city, which is illustrated on this page. This attachment comprises a freely mounted turntable carrying two vertical blades arranged to be set in front of the fan and connected to a simple reversing mechanism which strikes against stop-pins, reversing the angular set of the vertical blades in a manner familiar to users of certain types of oscillating fans. Any ordinary stationary fan may thus be set on the turntable, clamped in place, and started as an oscillating fan. The stop-pins are adjustable, making it possible to vary the amplitude of oscillation from seventy-two to 360 degrees of arc.

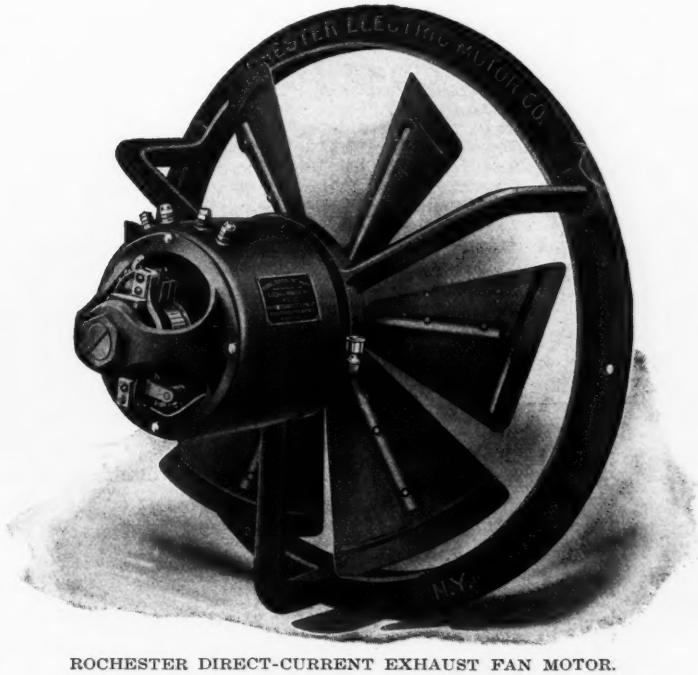
The turntable, which is carried on ball bearings, moves easily and noiselessly, and the oscillator provides a simple and practical application of old fans to a prolonged period of usefulness.

This device was placed on the market for development purposes late in the season last year, and in spite of the fact that no advertising was done and very little publicity given it, a large number were sold and many orders billed from foreign countries. Since the close of the last season the Simplex company has increased its factory equipment, and much preparatory work has been done on this device, as a large sale is expected during the coming season.

The Simplex oscillator will be sold by all electrical dealers and information concerning it may be obtained from the offices of the company at 90 West Street, New York city, and 315 Dearborn Street, Chicago.

ROCHESTER ELECTRIC MOTOR COMPANY.

The motor for the new exhaust fan of the Rochester Electric Motor Company, Rochester, N. Y., has been designed



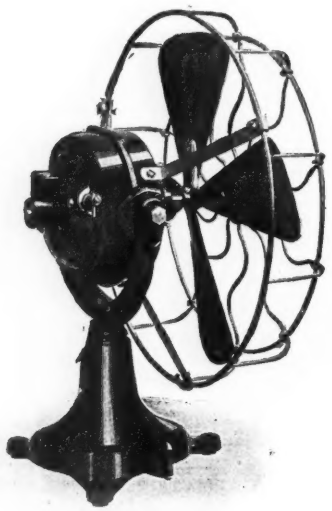
ROCHESTER DIRECT-CURRENT EXHAUST FAN MOTOR.

especially for severe service; is series wound; the bearings are unusually large and practically dustproof, as well as being very easily replaced, if it should be necessary. The bearing is of ball-and-socket type, one-half the ball resting on a half spherical seat integral with the supporting bracket, the other half seat being an adjusting cone held in place by locknut. Provision is made to oil the bearing on the fan end without danger of getting caught in the blades, and as an open motor, the temperature rise does not exceed thirty-five degrees centigrade above the surrounding temperature. This allows ample leeway for handling hot air or for being located in unusually warm places. When desired, the motors can be furnished entirely enclosed. The shape of the fan blades is such that a nearly uniform velocity is maintained across the entire face of the fan, which not only makes it possible to work against great back pressure, but enables the fan to handle a large volume of air with a low energy consumption.

NATIONAL ELECTRICAL SUPPLY COMPANY.

After ten years' experience in producing the Crescent direct-current desk and ceiling fans, the National Electrical Supply Company, of Washington, D. C., has improved its standard models for 1909 in both construction and finish. These fans have won for themselves a good reputation for serviceability and economy in both initial cost and in operation. The desk fans are made in either the solid or swivel and trunnion frame and have a four-point switch in the base for three-running speeds. They are made for 110 or 220 volts in either the twelve or six-

teen-inch sizes. The ceiling fans are made with four sixty-inch blades running at 225 revolutions per minute. Arrangements have been made with the Pennsylvania Electric Company, of Marietta,



CRESCENT DESK FAN—SWIVEL AND TRUNNION TYPE.

Pa., to manufacture and sell Crescent desk and ceiling fans.

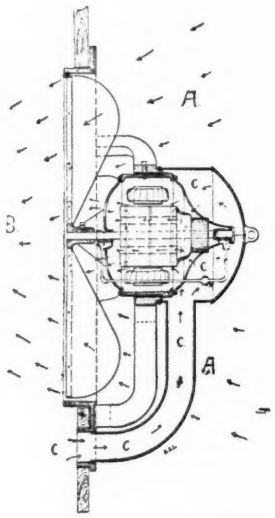
ILG ELECTRIC VENTILATING COMPANY.

The Ilg Electric Ventilating Company, Chicago, Ill., has brought out an exhaust fan in which the motor is kept cool by the fan itself. A current of cool, clean

CRESCENT CEILING FAN.

air from outside the premises is drawn in through the small tube connecting with the hood, which completely encloses the motor on all sides but the front, as shown on the sectional diagram. The air, after cooling the motor, is carried away with the general exhaust.

The motor used is of the round-body type and built on the interchangeable system, and can be removed from the supporting ring by removing three cap



ILG SELF-COOLED VENTILATING FAN.

screws, and can be replaced without disturbing the alignment. The two bearings on the motor are combined, insuring thorough lubrication of bearings.

The Connecticut Volt-Ammeter.

The Connecticut Telephone and Electric Company, Incorporated, of Meriden, Conn., has placed on the market its new type, 1909, dead-beat meter for testing batteries. These instruments have many improvements of note over the 1908 style. A new etched-metal dial now replaces the paper dial which is universally used for this purpose. This dial is a handsome addition to the instrument and adds greatly to its accuracy, doing away with the common trouble of warping and bulging of the card, which causes the pointer to stick in taking a reading. The entire interior construction has been changed and is now made up on the dead-beat principle. A new type of pointer construction has also been added.

The Connecticut company is making a number of different styles of pocket-battery meters. The volt-ammeter is really two instruments in one, the voltage side being used for testing storage batteries and the current side for testing the condition of dry batteries. This new type of instrument is a worthy addition to the already large line of high-grade Connecticut products.

Chloride Accumulators Summoned Aid to the "Republic."

One of the most interesting features in connection with the recent loss of the steamship Republic, which has been graphically reported in the daily press, is the forcible demonstration of the value of wireless telegraphy in keeping ships in touch with each other at sea, and with the stations on shore.

The Republic, as well as all the other vessels equipped with the Marconi wireless apparatus, carried as an alternate source of power, a battery of Chloride Accumulators, manufactured by the Electric Storage Battery Company, Philadelphia, Pa.

The collision rent a hole in the Republic that flooded the engine-room and also the compartment where the storage batteries were kept. Although under water, the Chloride Accumulators answered the demand and supplied the power to attract and communicate with the other ships for several hours. These communications were continued almost until the Republic sank.

That these batteries successfully met the requirements of an exceedingly difficult situation is a credit to their manufacturer and to the foresight of the Marconi company in providing against total disablement of the wireless apparatus through accident to the regular source of power.

All of the White Star steamships are equipped with Chloride Accumulators. The following letter from the Marconi Company is expressive of its appreciation of the batteries:

"For your information, it gives us pleasure to state that this company uses exclusively the Chloride Accumulators at all of its ship and shore stations, and they have always given us the best of satisfaction.

"Marconi Wireless Telegraph Company of America,

"(Signed) F. M. Sammis,
"Chief Engineer."

Trolley Cars to Carry Fire Engines.

To secure speedy responses to fires in the vicinity of Trenton, N. J., Fire Chief Allen has arranged with the local and suburban trolley lines for the construction of trucks to transport fire apparatus.

Many towns in New Jersey and Pennsylvania will be protected in this way. The need for the trucks was made apparent when the recent Princeton fire occurred.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, JANUARY 30.—The subject of running alternators in parallel was the topic of a discussion at the meeting of the Institution of Electrical Engineers, where a paper was read by Dr. E. Rosenberg. Hunting troubles, said Dr. Rosenberg, are mostly due to resonance, which causes a multiplication of small oscillating forces contained in the torque diagram of the driving engine. Theoretically all of the oscillating forces contained can give rise to such resonance. At the present state of the art, however, with the usual degrees of cyclic irregularity in reciprocating engines, it is mainly an oscillating force with a period at least four times as long as the period of the main oscillations, which causes difficulties in certain machines. So in slow-speed, two or three-crank steam engines where the oscillation of the biggest amplitude lasts one-quarter or one-sixth of a revolution, the dangerous amplitude has the duration of one revolution. In multiple-cylinder four-cycle gas engines, with main oscillations of half a revolution or less, the dangerous oscillation has mostly a period of two revolutions. In high-speed engines it is easy and, for mechanical reasons, general practice to apply a greater flywheel effect than the critical one. In slow-speed machines when such a flywheel effect would be prohibitive it is important to reduce the oscillations in question to the smallest possible value and to apply an amortisseur. If the flywheel effect is well over the critical point an amortisseur is unnecessary, although it is beneficial in the case of engines of irregular disturbances in the diagram. The point of resonance is characterized by the reaction quotient; i. e., the ratio, for a certain displacement, of the additional torque to the initial oscillating torque that causes this displacement. For full resonance this quotient is unity. If the flywheel cannot be altered the critical value can be avoided by adequate choice of the short-circuit current of the electrical machine, provided that this is consistent with the specified electrical regulation. The air gap may be either increased or reduced for this purpose, or choke-coils may be used instead of an air-gap reduction.

What at one time threatened to be a serious competitor with the famous Victoria Falls Power Company in the Rand has been overcome by the usual process of amalgamation. Although a new power company is to be registered with the title of the Rand Mines Power Supply Company, it is officially announced that the two concerns will work in harmony and that the power stations of the new company will form part of the greater scheme now being pushed forward by the Victoria Falls Power Company.

Both the Liverpool and the Manchester Corporations have abandoned their idea of adopting the trolley omnibus system for tramway extensions. At Liverpool a town meeting voted against the proposition because it was intended to carry goods upon the omnibuses, which, it was claimed, was an interference with private traders, while at Manchester a similar town meeting defeated the proposal on account of the lack of definite information about the possibilities of the system and the absence of its adoption in any large town. G.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, FEBRUARY 5.—The passenger traffic of the Ottawa Street Railway for the past year amounted to 13,711,000 persons, being an increase of more than 1,000,000 over the previous year. In 1892, the initial year of the company, only 500,000 passengers were carried and the total revenue was $72,000. The gross earnings last year were $616,229, or $41,350 more than in 1907.

The statement made by the Minister of Customs in the Canadian Parliament shows that the quantity of electrical energy exported by the Canadian power companies at Niagara Falls since the coming into force of the Electricity Exportation Act in 1907 was 381,000,000 kilowatt-hours. No persons or corporations have commenced the exportation of power since the act came into force. The power exported is supplied to the Niagara, Lockport and Ontario Company of Buffalo as a continuous supply of 18,000 horsepower and the Cataract Power Conduit Company, Buffalo, 33,000 horsepower. Licenses are issued for one year and are renewable. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, FEBRUARY 4.—At Regina, Saskatchewan, the Silverton, Florence and South Antler rural telephone companies have been granted incorporation, each with a capital of $5,000. Information may be obtained by addressing Francis Dagger, provincial telephone expert, Regina.

The Winnipeg Electric Railway Company has paid to the city treasurer at Winnipeg, Man., a check for $44,981.63, being five per cent of the company's earnings for 1908. The company has also paid in a check for $3,500, being the tax of $20 per car on 175 passenger cars. The company refuses to pay taxes on its sixteen construction cars, sweepers and snowplows, as well as on a passenger car which was burned shortly after it was put in use. A case is now pending in the courts to settle this contention.

The Canadian Pacific Railway steamers on Lake Superior will be fitted with wireless instruments at once. Last week the Princess May, running between Vancouver and Alaska, and also owned by the Canadian Pacific Railway, was fitted with instruments.

The Northwestern Electric Light and Telephone Company of Yorkton, Saskatchewan, has declared a dividend of six per cent for 1908, and will increase its capital stock from $20,000 to $50,000.

IMPORTANT DEVELOPMENTS.

WIRELESS TELEGRAPH EQUIPMENT FOR ALL SEA-GOING VESSELS—President Roosevelt has received a report from the commission named by him to revise the laws applying to safety of life at sea. It contains a number of important recommendations, among them wireless instruments upon all large steam and sailing vessels. The Burke bill for this purpose, which is pending in Congress, will be urged by the President. This bill was favorably reported by the subcommittee after Representative Wilson of Illinois made a futile demand that the measure should apply to lake vessels as well as to sea-going vessels.

WISCONSIN TELEPHONE COMPANY (BELL) NOT A TRUST—Attorney-General Gilbert of Wisconsin in deciding that the Wisconsin Telephone Company, a Bell property, is not a trust, as alleged by the Independent Telephone Association of Chicago, has declined to allow the independents to begin suit in the name of the state for the forfeiture of the charter of the Wisconsin Telephone Company. Attorney-General Gilbert's ruling is that the public utility law of Wisconsin forces any public-service corporation to give efficient service, so that there can be no application of the anti-trust statutes in the case of such service, either telephone or telegraph.

PROPOSALS.

UNITED STATES POST OFFICE AT MOLINE, ILL.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until March 10 for the construction complete of the United States Post Office at Moline, Ill., in accordance with specifications, which may be had from the office of the postmaster at Moline, or the office of the Supervising Architect.

UNITED STATES POST OFFICE AT ELIZABETH, N. J.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until March 9 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Elizabeth, N. J., in accordance with specifications which may be obtained from the custodian of site at Elizabeth, or at the office of the Supervising Architect.

NEW MANUFACTURING COMPANIES.

PITTSBURG, PA.—The Morgan Electroplating and Manufacturing Company has been incorporated by J. R. Morgan, H. O. Spangler and A. W. Kelley with a capital stock of $25,000.

CHICAGO, ILL.—The Anhydrous Battery Company, whose office is at 1117 Monadnock Block, Chicago, has been capitalized at $5,000 by William H. P. Weston, Frances Agnew and H. R. Samuels.

ELECTRIC LIGHTING.

(Special Correspondence.)

UNION, IOWA—The Union Electric Light Company has been voted a franchise. P.

ASHBURN, GA.—The city of Ashburn has voted $55,000 for electric-light, waterworks and school bonds.

OELWEIN, IOWA—The Oelwein Light, Heat and Power Company proposes spending $35,000 in improvements. P.

HOBART, OKLA.—The Hobart Motor Power Company has been incorporated with a capital stock of $10,000. P.

OPELOUSAS, LA.—The mayor of Opelousas will receive bids for an issue of $40,000 of electric-light and water bonds.

SOLDIERS GROVE, WIS.—The electric-light system is being repaired and changed from a 220-volt circuit to a 110-volt circuit. C.

BARTLESVILLE, OKLA.—The Bartlesville Electric Light and Power Company has been organized, with a capital stock of $60,000. P.

DES MOINES, IOWA—It is proposed to install artistic electric-light posts on walls, which are to be constructed on each side of the Des Moines River. C.

BATESVILLE, ARK.—H. H. Bine is preparing to construct a dam across Buffalo River, from which electric power is to be derived.

FAUNSDALE, ALA.—Sydon Stollenwerck, town clerk of Faunsdale, invites correspondence from manufacturers relative to the construction of a proposed electric-light plant.

HOUMA, ALA.—Anderson Offult, of New Orleans, La., has been employed by the Houma board of aldermen to build an electric-light plant, for which plans have been drawn.

LENOIR, N. C.—Eugene Ivey, superintendent of the Lenoir electric-lighting plant, states that the plant will probably be enlarged in the near future to meet increased demands for power. L.

DENVER, COLO.—The Northern Colorado Power Company has arranged to cancel its $3,000,000 first mortgage made in 1906 and has filed a new first mortgage to secure $6,000,000 five-per-cent bonds.

PINEVILLE, KY.—B. H. Broughton, city clerk, has prepared an ordinance and will soon advertise for bids for a twenty-year franchise for an electric-lighting and power system, the plant to be of at least 180 kilowatts capacity.

AUGUSTA, GA.—At a meeting, recently, of the stockholders of the Twin City Power Company, at Parksville, S. C., the stock of that company was increased to $3,000,000 and an issue of $3,000,000 first-mortgage bonds was authorized. B.

MANNINGTON, W. VA.—The Consumers' Electric Light Company of Mannington has been incorporated with a capital stock of $100,000 by C. E. Morris, H. A. Nolt, Herman A. Hundt, J. T. Westwood and B. S. Honecker, all of Wheeling, W. Va.

HUDSON, WIS.—At the annual meeting of the St. Croix Power Company the following officers were elected: J. M. McCarthy, president; H. C. Baker, vice-president; J. P. Crowley, secretary and treasurer, and Allanson P. Lathrop, assistant secretary. C.

ATLANTA, GA.—The Piedmont Power Company, 811 English-American Building, Atlanta, has been incorporated with a capital stock of $3,000,000. The officers are Louis B. Magid, Tallulah Lodge, Ga., president, and J. S. B. Thompson, secretary-treasurer.

CHEBOYGAN, MICH.—The Cheboygan Electric Light and Power Company and the Cheboygan Gas Light Company have been sold to the United States Equipment Company, whose head office is at Chicago. The new company proposes a marked reduction in rates.

MAMMOTH SPRING, ARK.—The Mammoth Spring Electric Light Company will replace its burned electric-light plant as soon as possible, rebuilding on an enlarged scale for day and night circuit and installing 150-kilowatt machines. Mrs. J. M. Archer is manager of the company.

SALINAS, MEXICO—The new power plant of the Benito Juarez Mining Company, at Salinas, is now in operation, generating power and light for the mines and mill ten miles away. Current at 10,000 volts is transmitted to the mine. The new plant is equipped for oil burning.

BOSTON, MASS.—President Charles L. Edgar, of the Edison Electric Illuminating Company, of Boston, has announced that negotiations which have been under way for some time for the purchase of the electric plants of the Waltham Gas Company, Newton & Watertown Gas Company, Boston Consolidated Gas Company and the Chelsea Gaslight Company, and for the furnishing of power for the street-railway lines of the Boston Suburban Company, have reached a successful conclusion. The authorization of the state will be asked, in order that the deals may be completed in accordance with the provisions of Massachusetts statutes.

SHARON, PA.—Stockholders of the Mahoning & Shenango Railway and Light Company will hold their annual meeting in New Castle February 16. Plans for improvements will be considered. An issue of $3,000,000 in bonds may be authorized, the money to be used in improvements.

HAWKINSVILLE, GA.—McDonald, McCoy & Company, Chicago, have purchased an issue of $15,000 five-per-cent, twenty-nine-year bonds of the town of Hawkinsville, at a premium of $675. The proceeds of the sale will be used for municipal ownership of the town electric-lighting plant. L.

CUMBERLAND, MD.—The plans of the Youghiogheny Power Company, to harness the Youghiogheny River, include the erection of three dams, thirty, seventy-five and 100 feet high, respectively, from which turbines will develop 15,000 horsepower. The estimated cost of the plant is $1,000,000. B.

MANISTEE, MICH.—The Manistee County Electric Company has filed articles of association and obtained a thirty-year charter to develop the waterpower on the Manistee River, eighteen miles from Manistee. E. N. Salling is president, R. W. Smith, vice-president, and Clyde J. Holmes, secretary and treasurer.

DENTON, MD.—The Peninsular Light and Power Company, 16 East Lexington Street, Baltimore, of which Thomas F. Garey is president, is to build a 100-horsepower plant, deriving power from a dam already built. The wheels are installed, but proposals for additional machinery and plant will be required about April 1.

MONTGOMERY, LA.—The Montgomery Light and Power Company has offered to put up and operate, free, a huge electric sign in some central point in the town to advertise the city, requiring only that the citizens shall agree upon some catch phrase or appropriate words to be flashed out on the sign by night. L.

BIRMINGHAM, ALA.—Louis Pizitz, a merchant of Birmingham, declares that he and his associates have decided to build a plant if the people of the city want competition against the Birmingham Railway, Light and Power Company. The merchants have the capital to build the plant if sufficient contracts can be secured. B.

HOUGHTON, MICH.—The Northern Michigan Power Company has been incorporated with a capital stock of $50,000 by Deen L. Robinson and others, for the purpose of damming the Sturgeon River and supplying water and electric power to Baraga, Houghton, Ontonagon, Marquette, Dickinson, Iron and Gogebic counties. C.

STEPHENSON, MICH.—With $15,000 as the consideration, the Electric Light and Power Company, of Iron Mountain, has purchased the Lower Twin Falls, on the Michigan side of the Menominee River, and will at once proceed with their development. It is estimated that not less than 500 horsepower can be developed at the falls at moderate cost.

CHARLOTTE, N. C.—The Charlotte Gas and Electric Company, with an authorized capital of $700,000, has filed articles of incorporation with the Secretary of State. It will supply private and municipal power, light, heat and fuel, in the forms of electricity, gas and other services. E. D. Latta, Thomas S. Allison and others are the incorporators, all of Charlotte. B.

FORT COLLINS, COLO.—That the waters of the Poudre River can easily be utilized to generate power for a municipal lighting plant is the opinion expressed by Prof. L. G. Carpenter, of the State Agricultural College, who has presented figures to substantiate his assertions. As a result a committee was appointed to confer with the City Council in the matter.

RICHMOND, VA.—The state corporation commission has issued charters for the Fredericksburg Electric Company and the Electric Generating Company. The Frank J. Gould interests control the waterpower at Fredericksburg, and the two charters are taken to mean the Washington, D. C., extension of the new electric line from Richmond to Ashland, seventeen miles north of Richmond. B.

CONNERSVILLE, IND.—W. W. McFarlan has applied for a franchise to operate a plant at Connersville for furnishing electric light and power. A petition signed by the majority of the business houses, asking that the franchise be granted, was read before the City Council. The new plant will be of about 500-kilowatt capacity, to be driven by direct-connected gas engines using natural gas.

SACRAMENTO, CAL.—George P. Robinson of Fair Oaks, near Sacramento, has taken an option on the capital stock, water rights, etc., of the North Fork Ditch Company for $350,000, $50,000 being paid down. The North Fork Ditch Company owns valuable water rights, heretofore used for irrigation purposes only, and it is understood that C. A. Smith and others, represented by Mr. Robinson, intend to use these rights for

the development of electric power for the operation of factories and lumber mills and for a proposed electric railway from Sacramento to Lake Tahoe. A.

YAZOO CITY, MISS.—A statement of the Yazoo City light and water plant for the past five years shows an apparent loss on this municipal investment of $13,865.89, which includes, however, nearly $13,000 of judgment and court costs for the death of a man on account of defective wiring. Since the disbursements included $28,000 paid for the old plant, it is seen that in the five years the plant has cleared nearly $15,000. B.

COLUMBIA, S. C.—A bill has been introduced in the state Legislature giving the right to street-railway companies to generate electricity, also for heating, lighting or power purposes either for their own use or for sale to municipalities or the general public. In view of the important bearing which this bill, as a law, would have on contemplated electrical companies, it has caused much debate, and is still under advisement by the legislative body. L.

GREENSBORO, N. C.—The sale of the properties of the Greensboro Electric Company to a syndicate, headed by Coler & Company, of New York, has been consummated. Properties included in the deal are the Greensboro street-railway and electric-lighting system, the Greensboro gas plants, and rights-of-way and franchises for interurban lines between Greensboro, High Point and Winston-Salem. The new owners will incorporate under the name North Carolina Public Service Company. Capital, $3,500,000.

SAN FRANCISCO, CAL.—Officials of the Great Western Power Company give out that for the time being the company will dispose of its power at wholesale only. Arrangements have been made with the Pacific Gas and Electric Company for the marketing of the Great Western Power Company's current in Oakland and Sacramento, and it is understood that a similar arrangement will be made for San Francisco as soon as the Great Western is in a position to supply current to the city. It will be several months before the latter company is ready to supply current in Oakland. A.

TOLEDO, O.—The case brought at Lima to test the validity of the recently enacted municipal ordinance for the purpose of erecting a lighting plant for the city, and which came up for hearing before Judge Hugh T. Mathers, has been postponed pending a proposed settlement of the litigation. Counsel for the Ohio Electric Railway Company produced in court a proposition signed by six members of the City Council, stating that they would accept an amended proposition for a contract with the city for lighting the streets, and it now looks as if an amicable settlement may be made and the municipal project abandoned. H.

MINNEAPOLIS, MINN.—Arguments in the case of the City of Minneapolis against the Minnesota Power and Trolley Company, Charles O. Straub and Joseph L. Kiichli, to recover on a $25,000 bond put up by the defendants as a guarantee when the city granted the company the right to construct its plant, have been begun. The company entered into an agreement with the city to have a plant and system of transmission of electrical energy and light ready for use by November 1, 1907. The City Council passed an ordinance giving the company privileges and it was agreed that $250,000 should be invested by November 1, 1907. The company has failed to build a plant or perfect an electrical system and the city demands the amount of the bond.

DETROIT, MICH.—The Electrical Distribution Company, Limited, of Windsor, Ontario, has been organized for the purpose of purchasing and distributing electric power from the Ontario Hydroelectric Power Commission. Those behind the company are a number of Windsor and Detroit men, the officers being: President, John Davis, of Windsor; vice-president, George M. Hendrie; secretary-treasurer, W. C. Kennedy, both of Detroit. Indications point to the supplying of Detroit manufacturers with power from Niagara Falls, a question that has been discussed with much interest and uncertainty ever since the Ontario government planned to bring power to the border. The new company plans to take 10,000 horsepower. The tunnel company, the street railways and other users of power outside of the municipality are the prospective customers.

READING, PA.—A new electric power house, with a modern transmission and distribution system, to cost about $1,750,000, will be erected in Reading by the Metropolitan Electric Company, which corporation is in the Interstate Railways Company. Edward B. Smith & Company, Philadelphia bankers and brokers, purchased $2,000,000 first-mortgage five-per-cent thirty-year sinking-fund gold bonds of the company, the proceeds of which will be used to build the plant and for the retirement of an existing issue of $150,000 bonds of the electric company, which are subject to redemption October 1, 1909, and will be called on or before April 1. Demand for current for light and power purposes in Reading had entirely outgrown the capacity of the station which the company is operating, and this station is incapable of further enlargement.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

EDDYVILLE, NEB.—The Eddyville Telephone Exchange has been incorporated with a capital stock of $1,000. P.

JAMESTOWN, N. D—The Wright-Allen Telephone Company has been incorporated. James Wright is secretary. P.

DEER RIVER, MINN.—An ordinance has been passed which grants a franchise to the Itasca Telephone Company. P.

ATLANTIC, IA.—The Musson Bros. Telephone Company has acquired the telephone system of W. J. Way of Carson. P.

COUNCIL HILL, OKLA.—The Council Hill Telephone Company has been incorporated with a capital stock of $10,000. P.

GLENWOOD, WIS.—The West Wisconsin Telephone Company has increased its capital stock from $12,000 to $20,000. P.

PIPESTONE, MINN.—The Northwestern Telephone Exchange Company will install an all-cable exchange at Pipestown. C.

REDWOOD FALLS, MINN.—The Redwood Falls Electric Telephone Company has been incorporated with a capital stock of $50,000. P.

CASHTON, WIS.—The Cashton Telephone Company has been incorporated with a capital stock of $24,000, by C. H. Cremer and Anna Schminger.

MICHIGANTOWN, IND.—The Michigantown Cooperative Telephone Company has been incorporated and will build and equip a telephone system in Michigantown and vicinity. S.

NEW YORK, N. Y.—The United Wireless Telegraph Company will equip at once the Royal Mail Steam Packet Company's steamers Nile and Clyde with its system of wireless telegraphy.

MONTREAL, CANADA—An order in council has been put into effect giving the railway commission supreme power over all the telegraph lines as well as the railroad lines in the Dominion of Canada.

SACRAMENTO, CAL.—A bill has been introduced into the Legislature providing for a tax of $1 per pole on each telephone pole in the state for the benefit of the municipalities in which the poles are located and for a further charge of five per cent on the gross income of the companies. A.

RALEIGH, N. C.—An unusual hearing has been begun before the North Carolina corporation commission to compel the Southern Express Company to install the telephones of the Raleigh Telephone Company. The Raleigh Telephone Company and the merchants' association of the city have instituted the proceeding, the merchants claiming that it is to their interest that the system mentioned should be used in the express company's offices. L.

TOLEDO, O.—In order to "demonstrate to customers the improved service of the company," the Home Telephone Company at Toledo has made arrangements for free long-distance telephone service between that city and Detroit during the entire month of February. The company recently installed several direct wires between the two cities. Manager E. L. Cline announces that many people are taking advantage of the generous offer of his company. H.

INDIANAPOLIS, IND.—The independent telephone companies of Indiana are not pleased with report of the Census Bureau relative to the number of independent plants, value of property and other statistics. Leading independent telephone men, however, say the managers of the companies are to blame rather than the Bureau. The companies made little effort to forward full returns, many failing to make out any at all. In consequence the showing is not satisfactory. S.

SAN FRANCISCO, CAL.—The Pacific Telephone and Telegraph Company has submitted its annual report to the Board of Supervisors. This gives the total value of the company's plant at $7,218,269, the San Francisco franchise being valued at $450,000. The gross receipts of the company in the city last year were $2,119,416, including $1,951,123 for local business, $63,033 for long-distance business and $105,260 for returns on real estate. The total expenses amounted to $1,602,000. A.

AUSTIN, TEXAS—A bill directly affecting the telephone and telegraph interests of Texas has been drafted by Senator J. M. Terrell and will be introduced in the Legislature. It provides that the State Railroad Commission shall have jurisdiction over telephone and telegraph lines the same as that body now exercises over railroads. This power includes the fixing of rates of these companies and requires that the improvements ordered by the commission shall be carried out. Mr. Terrell has also introduced a bill in the Legislature making telephone companies liable in civil suits for a fine of $500 whenever charges are made for long-distance service in excess of the actual time occupied in talking; also in cases where telephone companies charge for messenger service where none was performed. D.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SANTA BARBARA, CAL.—The Santa Barbara Consolidated Railway Company has been granted a franchise on Bath Street in Santa Barbara. A.

OSHKOSH, WIS.—The ordinance granting the Wisconsin Electric Railway Company the right to change the tracks of the city system has been tabled by the City Council. C.

SIOUX CITY, IOWA—According to M. H. Miller, the head of the company which is planning the interurban line between Sioux City and Des Moines, work will shortly be commenced on the right-of-way. C.

GOLDSBORO, N. C.—The Goldsboro Traction Company, which is building a local street-railway system, has been formally incorporated with $150,000 capital, with E. T. Oliver, of Raleigh, as the principal stockholder. L.

MINNEAPOLIS, MINN.—The Electric Short Line Company has bought a right-of-way from the city limits of Minneapolis to Wayzata, via Medicine Lake, for the construction of a new line to Lake Minnetonka. C.

PERU, IND.—Plans are being made to construct a new interurban line from Peru to Rochester. Local and foreign capitalists are interested. A meeting for the organization of a company will be held soon. S.

SEYMOUR, IND.—The County Commissioners have ordered an election in Jackson township to vote on a proposition to levy a subsidy tax of $40,000 in aid of the construction of the Seymour & Brownstown Electric Railway. S.

DES MOINES, IOWA—The survey for the interurban electric line of the Red Oak & Northwestern, from Red Oak to Des Moines, via Cumberland, Greenfield, Redfield and Adel, has been completed by B. Schreiner, formerly city engineer. C.

FRANKFORT, IND.—Oliver H. Gard, president of the Kokomo, Frankfort & Terre Haute Traction Company, announces that construction work will soon be begun on a line to connect Kokomo, Frankfort, Colfax, Crawfordsville, Rockville and Terre Haute. S.

EVANSVILLE, IND.—The Evansville & New Harmony Traction Company has been formed to build a traction line to connect Evansville and New Harmony. The line will traverse a very rich agricultural territory that is now without railroad facilities. S.

NEW CASTLE, IND.—The officials of the Indianapolis, New Castle & Toledo Traction Company have announced plans almost completed for the immediate resumption of work on the uncompleted portions of the line between New Castle and Indianapolis. S.

TEXARKANA, ARK.—W. F. Little, a street-railway promoter, who built the systems at Corsicana and other Texas cities, has been in Texarkana representing certain eastern capitalists who propose to build an interurban line from Texarkana to Sherman, Tex. B.

WICHITA, KAN.—Men interested in the building of a railroad from Wichita to Kinsley, Kan., have decided to make a survey of the proposed road at once. Levi S. Smith, of Kinsley; L. Brown, of Pensacola, and R. M. Cheatum, of Langdon, are to push the project.

NEW CASTLE, IND.—The New Castle Union Railway Company has been organized to build a traction line from New Castle to Middletown by way of Sulphur Springs and other intermediate towns. Thomas B. Millikan is president and Albert D. Ogborn, secretary. S.

EVANSVILLE, IND.—The survey of the Evansville, Mt. Carmel & Olney Traction Company route has been completed as far as Owensville. The farmers are granting the right-of-way and may do some of the grading, so anxious are they for the road. Work is to begin early in the spring. S.

OCONOMOWOC, WIS.—The state rate commission has granted a certificate of convenience and necessity to the Milwaukee Electric Railway and Light Company to extend its interurban lines from Wauwatosa to Oconomowoc. It is expected that the entire line will be finished within two years. C.

ATLANTA, GA.—The annual election of directors and officers for the Georgia Railway and Electric Company was held on January 27. President P. S. Arkwright was re-elected, C. E. Brine was chosen vice-president, treasurer and general manager, and W. H. Glenn, secretary and manager of railways for the company.

CHEHALIS, WASH.—The Twin City Light and Traction Company has filed articles of incorporation to furnish power for railway purposes and to generate electricity for lighting purposes in Chehalis and Centralia. The power plant is to be located at Chehalis. The incorporators are C. L. MacKenzie, A. Welch and T. J. Patterson, of Portland.

LAFAYETTE, IND.—A large power plant is soon to be built at Lafayette by the Fort Wayne & Wabash Valley Traction Company to augment the plant in Fort Wayne. The directors of the company have met here with President J. Levering Jones and M. J. Collier, of the Independent Trust Company, of Philadelphia, and provided the funds for building the plant.

ALBANY, N. Y.—The Public Service Commission, Second District, State of New York, has authorized the Western New York & Pennsylvania Traction Company to issue to the Trust Company of America a mortgage for $5,000,000 supplemental to its mortgage executed to the Colonial Trust Company, this company having been merged into the Trust Company of America.

SOUTH BEND, IND.—At the annual meeting, February 4, of the directors and stockholders of the Chicago, South Bend & Northern Indiana Railway the following directors were elected: C. F. and A. E. Dieterich and T. S. Krutz, New York city; W. V. Stuart and Samuel and Charles Mudock, Lafayette, Ind.; H. J. McGowan and Robert Todd, Indianapolis, and Harry B. Smith, Hartford City, Ind. S.

PEORIA, ILL.—The Chicago & Alton Railway, which has been experimenting with the Strang gasolene motor car, is well pleased with the performance of the car and has placed an order for four more, to be used on the branch lines of the company where the traffic is not enough to justify heavier train service. The company will put on a car between Bloomington and Dwight, and also between Peoria and Springfield. V.

AUSTIN, TEX.—A proposed amendment to the constitution of Texas, which has for its object the encouragement of interurban electric-railway projects in the state, is pending in the Legislature. Its provisions give counties the right to vote taxes and issue bonds to build or aid in the building of interurban electric railways. It is said that the construction of several lines will be undertaken upon the adoption of the amendment.

HONOLULU, H. I.—The Pearl Harbor Traction Company has been formed by L. Tenney Peck, A. L. Castle, C. H. Atherton and others connected with the Honolulu Rapid Transit Company, with a capital stock of $100,000, for the purpose of building an electric railway from the present terminal of the latter company's line at Kalakaua Avenue and Saratoga Street to the site of the proposed United States Government Works at Pearl Harbor. A.

CARTHAGE, MO.—W. W. Calhoon, T. K. Irwin, Fred Fitch and J. W. Ground have purchased the stock of the Girard Coal Belt Electric Railroad Company, a line extending through fourteen miles of coal-mining district in Kansas from Girard to Crowsburg. The purchasers are all stockholders in the Joplin & Pittsburg line, so it would seem that the road will be built from Pittsburg on north and eventually be extended to Fort Scott, thence to Kansas City.

PARSONS, KAN.—The Parsons electric-light plant has been sold to the Parsons Street Railway and Electrical Company for $90,000. The company has a street-railway franchise and will commence the construction of the street-railway system at once, and will spend about $50,000 on the rebuilding of the electric-light plant. It is capitalized for $400,000. Albert Emanuel, of Dayton, Ohio, is president; W. T. Neligh, of Parsons, vice-president, and W. R. Sullivan, of Dayton, Ohio, secretary and treasurer.

RICHMOND, VA.—Preparations for the building of the electric line between Richmond and Washington are believed to be under way. The road is already in operation to Ashland. Judge A. T. Embrey, of Fredericksburg, has applied to the state corporation commission for two charters for electrical companies—one for the city of Fredericksburg and the other with broader powers and rights for the counties of the state. Judge Embrey is secretary-treasurer of both companies, the Fredericksburg Electric Company and the Electric Generating Company of Fredericksburg.

PERU, IND.—The work of completing the Peru extension of the Winona Traction Company's line, which will be accomplished shortly, means through trolley service from Indianapolis to Gary and Hammond, by way of Warsaw, Goshen, South Bend and other important points. F. A. Potts, treasurer of the Winona Traction Company, announces that, with the completion of the extension, the operation of Sunday trains will be begun on the entire system. This move will be an innovation for this interurban line whose directorate is controlled by a religious assembly at Winona. S.

GREENSBORO, N. C.—The sale of the properties of the Greensboro Electric Company to a syndicate headed by Coler & Co., of New York, has been consummated. Included in the sale is the Greensboro street-railway and electric-lighting plant, gas plant, and rights-of-way and franchise for interurban lines between Greensboro, High Point and Winston-Salem. The new company is to be known as the North Carolina Public Service Corporation, capital $3,500,000, with privilege of increasing to $5,000,000. The work on the interurban line is to begin at once, as soon as the Greensboro city railway can be overhauled. B.

PERSONAL MENTION.

MR. C. G. GOODRICH will succeed Thomas Lowry as president of the Twin City Rapid Transit Company of Minneapolis, Minn.

DR. HENRY M. STEIN of Harrisburg, Pa., has succeeded E. S. Smith of Towanda, Pa., as secretary of the Pennsylvania Electric Association, which will have its headquarters at Harrisburg in the future.

MR. L. B. M'CLEARY of Niagara Falls, Ontario, Canada, formerly associated with the Ontario Power Company, has been appointed manager of the Falls Power Company, with headquarters at Welland, Ontario. W.

MR. W. A. ESSELSTYN, for many years connected with the treasury department of the Westinghouse Electric and Manufacturing Company, has been elected secretary to succeed Charles A. Terry, who was recently elected a vice-president.

MR. JOHN I. BEGGS is hereafter to devote his undivided attention to the management and development of the Milwaukee street-railway and lighting companies. With this end in view Mr. Beggs has tendered his resignation of the management of the St. Louis companies to the directors of the North American Company, owner of the properties in both cities, at the annual meeting in New York city. It is announced from St. Louis that Captain Robert McCulloch, vice-president and general manager of the United Railways Company, will probably succeed Mr. Beggs as the head of the company. The resignation of Mr. Beggs also means his retirement from the vice-presidency of the Union Electric Light and Power Company of St. Louis.

MR. LOUIS CHARLTON FRITCH is to have charge of the electrification work of the Illinois Central Railroad, with the title of consulting engineer. The position of assistant to the president, which Mr. Fritch has held for about two years, is to be filled by Donald Rose, who has been general European agent of the Illinois Central for about five years. Mr. Fritch has had charge of the investigation which the Illinois Central has been making into the feasibility of electrifying the Chicago terminal of the road. He has had a long railroad experience in both the engineering and operating departments, and, prior to becoming assistant to President Harahan, was assistant general manager of the Illinois Central and division superintendent of the Baltimore & Ohio Southwestern division. He was graduated from the University of Cincinnati as a civil engineer and subsequently took a course in law and was admitted to the bar in Ohio. He is vice-president of the American Railway Engineering and Maintenance of Way Association and is a member of the American Society of Civil Engineers.

OBITUARY.

MR. THOMAS LOWRY, president of the Twin City Rapid Transit Railway and the Minneapolis, St. Paul & Sault Ste. Marie Railroad, died at his home in Minneapolis, Minn., on February 4. Mr. Lowry had been a sufferer from tuberculosis of the lungs for several years. He was sixty-six years of age, having been born on a farm in Logan County, Illinois, February 21, 1843. After having acquired an education he studied law and was admitted to practice in 1867. In 1884 he abandoned law to direct the policies of the street-car service of Minneapolis and St. Paul, which he built up until today it is one of the best equipped systems in the United States.

NEW PUBLICATIONS.

1908 CONVENTION PROCEEDINGS OF THE MICHIGAN ELECTRIC ASSOCIATION—The proceedings of the Michigan Electric Association convention held at Grand Rapids, August 18-20, 1908, have just been issued in bound form. The book comprises a verbatim report of all the papers and discussions, together with the reports of the officers and committees.

REPORT ON REGULATION OF GAS SERVICE FOR CHICAGO—Messrs. D. C. and W. B. Jackson, engineers, have submitted to the Chicago City Council committee on gas, oil and electricity a report on the question of suitable regulation of gas service for the city of Chicago. The report specifies the heating and illuminating value of the gas, the required pressure and possible fluctuations, and the methods of testing illuminating gas supplied to Chicago consumers.

UNITED STATES MAGNETIC TABLES AND MAGNETIC CHARTS FOR 1905—The work carried on by L. A. Bauer, inspector of magnetic work and chief of the division of terrestrial magnetism of the United States Coast and Geodetic Survey, and his assistants, has been collected for the year 1905 in a bound volume of 150 pages, with maps. It contains tables and maps of the magnetic elements in the United States for January 1, 1905, supplying graphical representation of declination, dip or inclination, horizontal and vertical components of the earth's field, and total intensity.

MUNICIPAL PLANT REPORT OF HOLYOKE, MASS.—The annual report of the gas and electric department of the city of Holyoke, Mass., for the year 1908, has been submitted by William H. Snow, manager. The local electricity business shows an increase of about ten per cent for the year. After meeting an expense account of $134,226, the receipts from the sale of current, $146,329, have permitted $12,103 to be written to the account of profit for the year. A recent reduction in the selling price for current took approximately $34,000 out of the receipts of the station, but the total surplus shows only about $10,000 below that of the preceding year.

THE ARMOUR ENGINEER, which is the semiannual technical publication of the student body at Armour Institute of Technology, Chicago, has made its initial appearance with the January number. The new magazine has 114 pages devoted principally to important technical articles by alumni of the institution. Among these may be mentioned, "Difficult Problems which Public Utility Commissions are Endeavoring to Solve," by H. C. Abell; "Personal System and the Constructing Engineer," by R. M. Henderson; "The Morgan Gas Producer Installation at Gary," by W. R. Wilson; "The Westinghouse-Nernst Lamp," by A. L. Eustice, and "Electrons," by G. E. Marsh, Jr. *The Armour Engineer* is ably edited by Tracy W. Simpson and is a credit to the institution from which it comes.

ELECTRICAL SECURITIES.

The stock market during last week continued dull and irregular, with little trading, and that mainly professional. A decided change for the better is not looked for in the immediate future. No developments of importance took place, though the December reports of a number of railroad lines, showing substantial increases in traffic, as compared with the same month a year ago, are regarded as encouraging.

Dividends have been declared upon the following electrical securities: Brooklyn Rapid Transit Company; an initial dividend of one per cent, payable April 1 to stock of record March 10. Brooklyn Rapid Transit directors passed resolutions making the dividend periods of the company April 1, July 1, October 1 and January 1. Quebec Railway and Light Company; an initial quarterly dividend of one per cent, payable March 1. St. Joseph Railway, Light, Heat and Power Company; regular quarterly dividend of one-and-one-half per cent on the common stock, payable March 1 to stock of record February 15. American Telegraph and Cable Company; regularly quarterly dividend of one-and-one-fourth per cent, payable March 1. National Carbon Company; preferred quarterly dividend of one-and-three-fourths per cent, payable February 15. United States Telephone Company; preferred quarterly dividend of one-and-one-half per cent, payable February 15.

ELECTRICAL SECURITIES FOR THE WEEK ENDED FEBRUARY 6.

New York:	*Closing.*
Allis-Chalmers common	14⅞
Allis-Chalmers preferred	46¾
American Tel. and Tel. Company	127½
Brooklyn Rapid Transit	71
General Electric	152½
Interborough-Metropolitan common	15⅛
Interborough-Metropolitan preferred	41½
Kings County Electric	124
Mackay Companies (Postal Telegraph and Cables) common	71½
Mackay Companies (Postal Telegraph and Cables) preferred	71½
Manhattan Elevated	148
Metropolitan Street Railway	25
New York & New Jersey Telephone	113½
Western Union	68
Westinghouse Manufacturing Company	80¼

The annual meeting of stockholders of the Mackay Companies will be held in Boston on February 15, at 10 a. m.

Boston:	*Closing.*
Edison Electric Illuminating	252
Massachusetts Electric	65½
New England Telephone	130
Western Telephone and Telegraph pref.	78
Philadelphia:	*Closing.*
Electric Company of America	11⅛
Electric Storage Battery common	43½
Electric Storage Battery preferred	43¼
Philadelphia Electric	11⅞
Philadelphia Rapid Transit	27
United Gas Improvement	94
Chicago:	*Closing.*
Chicago Telephone	128
Commonwealth Edison	107½
Metropolitan Elevated preferred	45
National Carbon common	82
National Carbon preferred	112

Heyliger A. de Windt, a large stockholder in Metropolitan Elevated, succeeds Moses J. Wentworth, resigned, on the Metropolitan board. Other directors were re-elected.

INDUSTRIAL ITEMS.

THE H. B. KIRKLAND COMPANY, New York city, has been appointed eastern selling agent for the Chicago Mica Company, Valparaiso, Ind., producer of mica for all purposes. The Chicago Mica Company is to be congratulated in securing so able a representative for the East.

THE SHULTZ BELTING COMPANY, St. Louis, Mo., has just secured a contract for the equipment of the largest lumber mill on the Pacific Coast. These belts will range in size from eight-inch, double-ply, to sixty-six-inch, three-ply. The company has also received a contract for 6,000 feet of belting for installations abroad.

DOSSERT & COMPANY, New York city, have received an order from the Wilson-Maeulen Company, New York city, for 200 solderless connectors to be installed on electric pyrometers; also an order from the American Electrical Supply Company, of Chicago, for 450 two-way and front lugs for use in the plant of the Buick Motor Company, Flint, Mich.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing circulars describing the tungstolite, a new fixture which has been developed for use with tungsten lamps of twenty-five, forty or sixty watts consumption. This fixture embodies several new features and will find a wide application in enabling central stations to fight gas competition. Circulars will be sent on request.

THE MINNEAPOLIS STEEL AND MACHINERY COMPANY, Minneapolis, Minn., has received an order from J. Everton & Son, Deer River, Minn., for an eighty-horsepower Muenzel producer-gas engine and gas-producer plant, and a fifty-three-kilowatt direct-current generator, which will be direct-connected to the engine. This machinery will be installed in the electric-light plant at Deer River.

THE ASHLAND ELECTRIC COMPANY, Chicago, manufacturer of the Ashland combination fixture stud, reports that this device is meeting with favor among contractors. It is designed for conduit, molding or open work, can be used as a crowfoot by removing the nipple, and will centre the screw holes when used on molding. This handy little device is already used by a number of prominent construction houses, and is handled by all the leading jobbers.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, has arranged a convenient binder for its bulletins. The company makes a specialty of manufacturing belted generators and motors, steel-frame bipolar generators and motors, engine-type direct-connected generators, marine-type direct-connected generating sets, multipolar-belted motors, induction motors and multipolar generators.

HAGSTROM BROTHERS' MANUFACTURING COMPANY, Lindsborg, Kan., has increased its capital stock from $50,000 to $150,000. The officers are: William Hagstrom, president; N. J. Thorstenberg, vice-president; Emanuel Hagstrom, secretary, and Gustaf Hagstrom, treasurer. For the last two years the company has manufactured the Hagstrom porcelain tube cutter, which is extensively used by electrical concerns, and will make a lockout system for telephones. The company made an exhibit at the Chicago Automobile Show, which was in charge of the Chicago sales agent, S. Breakstone.

THE CROCKER-WHEELER COMPANY of Ampere, N. J., has just closed a contract to equip with motor drive the new wood-working factory of the John Hofman Company, Rochester, N. Y. The order includes forty induction motors ranging from one to thirty horsepower, with a total capacity of about 200 horsepower. These motors will be used for individual drive, each machine being equipped with its own motor. The motors, with the exception of one, are of the squirrel-cage type. The generator for this plant and three lighting transformers are also included in the order placed with the Crocker-Wheeler Company.

THE NORTHERN ELECTRICAL MANUFACTURING COMPANY, Madison, Wis., according to its president, A. O. Fox, has arranged for a joint sales organization with the Fort Wayne Electric Company, Fort Wayne, Ind., manufacturer of electrical apparatus of a non-competing nature. While the combined sales forces are not to be curtailed below their original individual numbers, the effectiveness of the new combination will be much increased. The Northern plant will continue to manufacture its regular line in addition to a full line of direct-current machinery in the larger sizes formerly manufactured at Fort Wayne, and will also continue to develop and broaden its field in the manufacture of specialties in motor appliances. The Fort Wayne company manufactures principally machinery and apparatus for alternating-current service.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the second issue of each month.)

ALABAMA LIGHTING AND TRACTION ASSOCIATION. Temporary secretary, F. K. Jackson, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, Walker Electric Company, Twenty-third and Noble streets, Philadelphia, Pa.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa. Next regular meeting, Niagara Falls, Ontario, May 6-8.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis Avenue, New York city.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Watchung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, Rossiter W. Raymond, 29 West Thirty-ninth Street, New York city.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West 116th Street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill. Annual convention, Atlantic City, June.

AMERICAN ROENTGEN-RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York city.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Forty-seventh Street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, A. P. Folwell, Flatiron Building, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineeering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, secretary and treasurer Tri-City Railway Company, Davenport, Iowa.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass.

AMERICAN STREET AND INTERURBAN RAILWAY TRANSPORTATION AND TRAFFIC ASSOCIATION.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, superintendent of lighting Hot Springs Light and Railway Company, Hot Springs, Ark.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF CAR-LIGHTING ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad, Chicago, Ill.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, D. L. Huntington, second vice-president and manager Washington Water Power Company, Spokane, Wash.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, Welles E. Holmes, 308 Washington Street, Newton, Mass.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Wisconsin Central Railway, Milwaukee, Wis.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Pioda, Oak and Broderick streets, San Francisco, Cal.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 33 Melinda Street, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Traction Terminal Building, Indianapolis, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Colo.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Conn.

ELECTRIC CLUB OF CHICAGO. Secretary, Wm. S. Taussig, 204 Dearborn Street, Chicago, Ill.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, George William Russell, Jr., 500 Fifth Avenue, New York city.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine Street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

ELECTRICAL TRADES ASSOCIATION OF CANADA, LIMITED. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, San Francisco, Cal. Monthly meetings, San Francisco, Cal., first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York city. Board of directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau Street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt Street, New York city.

ENGINEERS' CLUB OF PHILADELPHIA. Secretary, H. G. Perring, 1317 Spruce Street, Philadelphia, Pa.

ENGINEERS' SOCIETY OF MILWAUKEE. Secretary, W. Fay Martin, Milwaukee, Wis.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. A. Camp, Henry, Ill.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Ottawa, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Van Rensselaer Lansingh, Engineering Societies Building, 33 West Thirty-ninth Street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Frederic Leslie, Muncie, Ind. Next meeting, August 18.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Allen J. Paylow, Rockport, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis, Parkersburg, W. Va.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Iowa. Annual convention, Cedar Rapids, Iowa, April.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Iowa. Annual convention, Des Moines, Iowa, March 9-11.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION Secretary, L. D. Mathes, Dubuque, Iowa.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill. Annual convention, Atlantic City, June.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. A. Burch, Battle Creek, Mich.

MILWAUKEE SOCIETY OF ENGINEERS. Secretary, W. Fay Martin, 456 Broadway, Milwaukee, Wis.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, Ludwig Kemper, Albert Lea, Minn. Second annual meeting, Nicollet Hotel, Minneapolis, Minn., March 18-19.

MISSOURI ELECTRIC LIGHT, GAS AND STREET RAILWAY ASSOCIATION. Secretary, Claude L. Clary, Sikeston Electric Light and Power Company, Sikeston, Mo. Annual convention, Springfield, Mo., April 15-17.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George W. Schweer, Windsor, Mo.

MUNICIPAL LIGHTING ASSOCIATION OF MASSACHUSETTS. Secretary, J. C. Norcross, Hudson, Mass.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Annual convention, Toledo, Ohio, July 21-25.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago, Ill.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, John F. Gilchrist, Commonwealth Edison Company, Chicago, Ill. Annual convention, Atlantic City, N. J., June 1-4.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, William Bradford, Lincoln, Neb.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 60 State Street, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass. Meetings held on fourth Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Temporary secretary, J. D. Crary, Aberdeen, Wash.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary-treasurer, John S. Allen, manager, Equitable Electric Light Company, Lake Geneva, Wis.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Toledo, Ohio, July 13-15.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, O. O. Welsheimer, Columbus, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD-TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, Frank J. Scherrer, New York city.

ORDER OF THE REJUVENATED SONS OF JOVE. Mercury, C. B. Roulet, Dallas, Tex.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Dr. Henry M. Stein, Harrisburg, Pa.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa. Next annual meeting, Louisville, Ky., October 12-14, 1909.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, J. A. Myler, Jr., 608 Juanita Building, Dallas, Tex. Annual convention, Dallas, Tex., May.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Company, New York city.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. A. Gould, Ennis, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasuer, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 382 Ohio Street, Chicago, Ill.

WESTERN SOCIETY OF ENGINEERING (Electrical Section). Chairman, William B. Jackson, 115 Adams Street, Chicago, Ill.

WISCONSIN ELECTRIC AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Clement C. Smith, president Columbia Construction Company, Milwaukee, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

DATES AHEAD.

Iowa Independent Telephone Association. Annual convention, Des Moines, Iowa, March 9-11.

Minnesota Electrical Association. Second annual meeting, Nicollet Hotel, Minneapolis, Minn., March 18-19.

Worcester Mechanical and Electric Exposition. Mechanics Hall, Worcester, Mass., March 27-April 3.

Louisville Electrical Show. The Armory, Louisville, Ky., April 12-24.

Missouri Electric Light, Gas and Railway Association. Annual convention, Springfield, Mo., April 15-17.

Iowa Electrical Association. Annual convention, Cedar Rapids, Iowa, April.

Southwestern Electrical and Gas Association. Annual convention, Dallas, Tex., May.

American Electrochemical Society. Next meeting, Niagara Falls, Ontario, May 6-8.

Omaha Electrical Show. Omaha Auditorium, Omaha, Neb., May 6-15.

National Electric Light Association. Annual convention, Atlantic City, N. J., June 1-4.

American Railway Master Mechanics' Association. Annual convention, Atlantic City, N. J., June.

Master Car Builders' Association. Annual convention. Atlantic City, N. J., June.

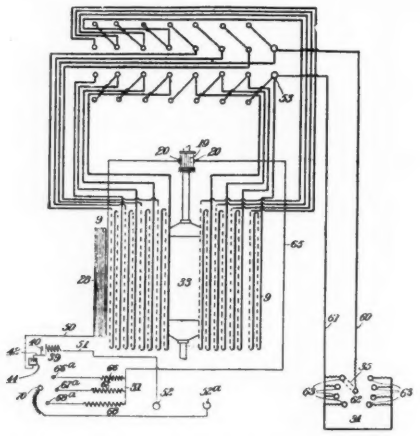
Ohio Electric Light Association. Annual convention, Toledo, July 13-15.

National Electrical Contractors of the United States. Annual convention, Toledo, Ohio, July 21-23.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) February 2, 1909.

911,029. CONTROLLER. Herbert W. Cheney, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed October 21, 1907. A motor controller has means for positively preventing speed-increasing movements of its members unless the current in the armature is below a predetermined value.



911,036.—INTEGRATING WATTMETER FOR ALTERNATING CURRENTS.

911,030. COMBINED CONTROLLER AND CIRCUIT-CLOSER. De Witt C. Cookingham, Cleveland, Ohio, assignor to the Rauch & Lang Carriage Company, Cleveland, Ohio. Filed September 11, 1907. Combined with a controller handle is a circuit-closing means and a hand-engaging part for holding this open except when the controller is in the off position.

911,032. ELECTRIC TERMINAL CLIP. Willard E. Dow, Braintree, Mass. Filed October 5, 1907. Comprises opposite jaws adapted to embrace a terminal post and having twisted portions intermediate their length for localizing the resiliency of the clip.

911,036. INTEGRATING WATTMETER. Benjamin E. Getchell and Oscar O. Smith, Connellsville, Pa. Filed February 26, 1908. In a meter adapted to operate on circuits of different frequencies and voltages the pressure coil has a variable resistance in circuit therewith and the series winding has a number of sections connected in different relations to vary the current-carrying capacity, but to maintain the ampere-turns practically constant.

911,055. MOUNTING FOR FUSES. John J. Lyng, New York, N. Y., assignor to Western Electric Company, Chicago, Ill. Filed May 23, 1907. A body of soft metal is molded at the end of a tube and a fuse wire passes through the tube and has its end imbedded in the soft metal.

911,072. MECHANISM FOR CONTROLLING TIME SWITCHES AND FOR OTHER PURPOSES. Justus N. Reynolds and Frank E. Buddington, Chicago, Ill., assignors of one-third to Abram Diefendorf, Chicago, Ill. Filed September 16, 1907. Combined with an electric switch and its terminals is a pivoted switch arm and a set of revoluble contact arms for alternately and positively shifting the pivoted arm in opposite directions.

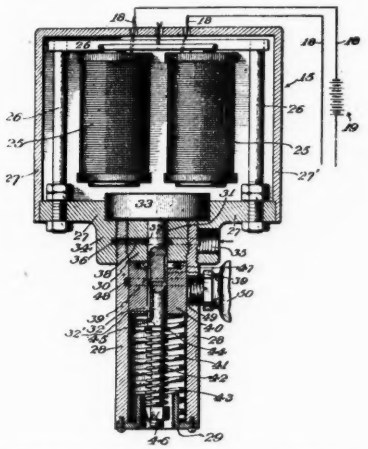
911,081. COLLECTOR RING AND CLAMPING PLATE. Charles H. Smoot and Hjalmar Hertz, Chicago, Ill., assignors to Western Electric Company, Chicago, Ill. Filed January 2, 1906. In a turbo-generator the rotating field magnet has end discs forming the terminals of the field winding, end clamping plates having electrical connections with the terminals and radial grooves on their outer faces, and collector rings integral therewith.

911,101. AUDIPHONE TRANSMITTER. Charles E. Williams, Natick, Mass. Filed August 6, 1907. Has a wave-transmitting diaphragm located at its back, a reverberatory chamber at its front for receiving the sound waves and directing them

against the front of the diaphragm and granular carbon arranged to rest loosely against the front of the diaphragm.

911,118. RAILWAY-SIGNAL SYSTEM. Richard B. Davis, Los Angeles, Cal., assignor of one-half to William K. Mason, Caliente, Nev. Filed November 8, 1907. An electrical circuit passing through the cars of a train includes a source of electrical energy and electromagnetic means to operate the valves of pneumatic signals.

911,139. ELECTRICALLY-ACTUATED HAIR AND WOOL CLIPPER. Hugo Luense, Chicago, Ill. Filed March 5, 1908. An electric motor of small diameter is mounted in the handle and drives the cutters, an incandescent lamp for lighting up the work being fixed on the frame.



911,118.—ELECTRO-PNEUMATIC RAILWAY SIGNAL.

911,141. PROCESS OF AGGLUTINIZING ACTIVE MATERIAL FOR ELECTRIC ACCUMULATORS. Quintin Marino and Edward W. Barton-Wright, London, England. Filed December 17, 1906. Consists in mixing castor oil with a small quantity of finely-powdered litharge and manganese peroxide, boiling the mixture and allowing it to clarify, decanting the oil from the precipitate, dissolving it in a hydrocarbon, and mixing the oil solution with litharge and acidulated water to form a paste.

911,147. INDUCTION MOTOR AND GENERATOR. Ralph D. Mershon, New York, N. Y. Filed April 29, 1905. The secondary element has one or more impedances, resistances and electrolytic condensers connected with the windings.

911,168. STORAGE-BATTERY PLATE. Edward W. Smith, Philadelphia, Pa. Filed April 13, 1908. Consists of a body part of fine ribs having between them spaces that extend clear through the plate and having crosswise reinforcing ribs and a frame, the sides of which are provided with a tapering web.

911,178. TELEPHONE RECEIVER. Herbert W. Sullivan, London, England. Filed November 30, 1907. Has a multiple-point spark gap in shunt with the magnets and within the casing.

911,181. INTER-COMMUNICATING TELEPHONE. Henry C. Thomson, Boston, Mass., assignor to Electric Goods Manufacturing Company, Boston, Mass. Filed March 30, 1907. A switch mechanism for inter-communicating telephone systems comprises a series of plungers sliding through a contact plate, a contact spring at the side of each plunger and a locking plate for retaining each plunger in engagement with its spring.

911,183. MEANS FOR CHECKING HORSES. Tobia Todisco, Philadelphia, Pa. Filed September 3, 1908. Comprises two electromagnetically-actuated presser buttons adapted to close against a horse's nostrils.

911,184. CONTROLLING MECHANISM FOR ELEVATORS. Frederick E. Turner, Kansas City, Mo. Filed August 24, 1907. Describes a method of control of the switches and clutches for the hoisting gear of an electric elevator.

911,188. TELEPHONE-TRUNKING SYSTEM. Charles S. Winston, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed January 3, 1905. Combined with a trunk circuit is a relay mechanism associated with the incoming end of the trunk and adapted to maintain current over the outgoing end to operate the cord-circuit drop after the subscriber hangs up his telephone and until the connection is severed with the outgoing end of the trunk.

911,190. AUTOMATIC RAILROAD SWITCH. Felix Wolf, New York, N. Y. Filed September 25, 1907. There are two motors to operate the switch, their armatures being connected to a screw transversely located between the rails and adapted to directly set and lock the switch.

911,209. RAIL-BOND PROTECTOR. William B. Cleveland, Cleveland, Ohio, assignor to the Electric Railway Improvement Company, Cleveland, Ohio. Filed October 28, 1907. A rail bond has a protecting armor of harder material and is welded to the armor and to the rail head.

911,222. TURBINE-BLADE-FIXING MACHINE. Sebastian Ziani de Ferranti, Hampstead, London, England. Filed September 26, 1904. A machine adapted to electrically weld turbine blades to their carrying elements.

911,231. TELEPHONE-TESTING SYSTEM. Harry C. Goldrick, Indianapolis, Ind., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed November 14, 1904. Each telephone line terminates at the central office in a two-point jack, one contact of the jack being both a testing and a talking contact, the testing circuits of the cord circuit being integral and free from series contacts during testing.

911,252. CUT-OUT SUSPENSION PULLEY. Charles S. Moon, Topeka, Kan. Filed April 13, 1907. The upper member is adapted to be secured to the span wire and has a hook; the lower member is adapted to have the lamp suspended and a drop cord secured to it and passing over the upper member.

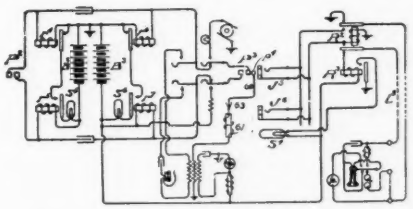
911,253. APPARATUS FOR APPLYING ADHESIVES. William N. Moore, Redlands, Cal. Filed July 24, 1908. Means for heating the contents of a receptacle consist of a tube submerged in the receptacle and an incandescent lamp adapted to be inserted into the tube.

911,260. APPARATUS FOR COLLECTING ATMOSPHERIC ELECTRICITY. Walter I. Pennock, Philadelphia, Pa. Filed June 26, 1907. A balloon carries an electrical collector comprising a non-conducting bar and a polished wire wound spirally thereon to form an open substantially spherical body.

911,303. ELEVATOR INDICATOR. John D. Griffen, New York, N. Y. Filed March 22, 1897. Combined with a series of switches and groups of indicators at different floors are branches arranged to complete the circuit of each group of indicators on the same floor through the switch at that floor.

911,338. CONNECTING-JACK FOR TELEPHONE SWITCHBOARDS. Charles H. Smith, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed December 30, 1904. A spring-jack comprises a frame having a portion of the rear thereof for supporting the jack springs.

911,339. PARTY-LINE INDICATING KEY. Charles H. Smith, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed August 5, 1907. A number of switch-actuating plungers and auxiliary rotating means for indicating the last plunger depressed.



911,231.—TELEPHONE-TESTING SYSTEM.

911,354. TRANSMITTING INSTRUMENT. George E. Winslow, Waltham, Mass. Filed July 31, 1908. Combined with two circuit controllers is an actuator for each controller and adapted to hold the controller in position to open the circuit.

911,363. SCOREBOARD. George E. Baird, Chicago, Ill. Filed April 15, 1908. A baseball scoreboard comprises a number of signaling plates bearing numbers or letters representing the respective players and main facts of the game, electrical means for exposing the signs upon the plates, and a keyboard by which this means is controlled to display and conceal individual signs at will.

911,364. DYNAMO-ELECTRIC MACHINE. Herbert A. Balcome, Boston, Mass., assignor to Holtzer-Cabot Electric Company. Filed July 1, 1907. An electric motor has a laminated field core provided with polar extremities.

911,377. PARTY-LINE INDICATING KEY. Guy M. Campbell, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed April 17, 1908. A modification of No. 911,339.

911,378. STOPPING MECHANISM FOR LOOMS. Thomas A. B. Carver, Glasgow, Scotland, assignor to Textile Appliances, Limited, Glasgow, Scotland. Filed February 10, 1908. The mechanism is under the control of an electromagnet.

911,384. KEYBOARD TELEGRAPHIC TRANSMITTER. Patrick B. Delany, South Orange, N. J. Filed May 26, 1905. Comprises a series of message-transmitting contacts and contact members adapted to traverse them.

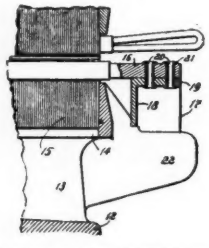
911,409. ARC-LAMP HEADLIGHT. Benjamin B. Lacy, Houston, Tex., assignor to Anderson-Lacy Electric Headlight Company. Filed September 24, 1907. A lifting device for arc lamps consists of an electrically-operated lifting rod and a clutch pivotally connected to one end of it.

911,411. CARBON HOLDER FOR ELECTRIC LAMPS. Carl J. Lang, Olean, N. Y. Filed April 30, 1908. An electrode holder for arc lamps.

911,414. MULTIPLE-CYLINDER-MOTOR IGNITION APPARATUS. Burton L. Lawton, Meriden, Conn., assignor to the Unit Coil Company, Jersey City, N. J. Filed June 19, 1907. A number of interchangeable induction coils are removably mounted in a casing, the secondary windings being connected to the spark plugs of the different cylinders.

911,429. CLEAT FOR ELECTRIC WIRING. Roderick McLennan, Ballston Spa, N. Y. Filed February 18, 1908. An angular porcelain cleat is arranged to support wires around a corner and has a right-angled body portion with a corner slot and a transverse slot near each end.

911,438. TELEPHONE RECEIVER. William E. Peters, Athens, Ohio. Filed December 24, 1907. Between the casing and the diaphragm are soft cushioning rings.



911,481.—SQUIRREL-CAGE ROTOR CONSTRUCTION.

911,439. CONTACT PLUG FOR ELECTRIC IRONS, HEATING APPLIANCES AND THE LIKE. Richard G. Pheysey, Ontario, Cal. Filed August 22, 1907. Screwed within the plug are two spring clips, each formed of sheet metal secured together so as to enclose one end of the lead wires, the two tongues secured to the terminals of an iron being adapted to project into the plug and between the spring clips.

911,446. THERMO-ELECTRIC PILE. Adolf Rittershaussen, Cassel, Germany. Filed June 9, 1908. Comprises a number of superposed annular couples, each formed of two components of different metals and each component consisting of two concentric cylindrical rings and arms between them.

911,447. ELECTRIC-LIGHT BRACKET. William Roessler, Olean, N. Y. Filed May 2, 1908. A tubular arm carrying a socket at its end swings on a pintle.

911,448. TROLLEY. Paul H. Rosskamp and Ludwig Kellermann, Tarentum, Pa. Filed August 24, 1908. Vertical arms loosely mounted at the sides of the harp extend upwardly over the wheel.

911,459. APPARATUS FOR THE MANUFACTURE OF LEAD-INCASED WIRE OR CABLES FOR ELECTRIC AND OTHER PURPOSES. Charles Tatham, New York, N. Y. Filed October 2, 1908. A reservoir for containing lead has a ram to force the lead, a bottom piece with a core and die for the passage of a cable and a conduit for cooling medium to temper the degree of the lead as it is forced about the cable by the ram.

911,472. ELECTRIC SAFETY RAZOR. Luigi Brunacci, New York, N. Y. Filed June 27, 1908. An electric motor drives a rotary blade.

911,475. MULTIPLE LAMP SOCKET. Leger J. Castonguay, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Filed August 5, 1908. Has a series of socket units, each with its axis inclined, but with its insulating base part parallel to the axis of the cluster.

911,481. INDUCTION MOTOR CONSTRUCTION. Henry F. Elshoff, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Filed February 7, 1906. A squirrel-cage rotor has a number of conductor bars, a conductoring ring at each end for short-circuiting the bars, and radial hollow rivets for connecting the bars and rings.

911,519. MEANS FOR ELECTRICALLY OPERATING THE OPERATING MECHANISM OF A FARE REGISTER. John F. Ohmer, Dayton, Ohio, assignor to Ohmer Fare Register Company, Rochester, N. Y. Filed October 3, 1907. The register is controlled by an electromagnet with a connection between its core and the actuating mechanism of the register.

911,522. ELECTRIC BATTERY HOLDER AND BATTERY. George L. Patterson, New York, N. Y., assignor to Alice C. Patterson, New York, N. Y. Filed April 18, 1908. A holder for dry cells is provided with two sets of terminals for connecting the cells conveniently.

911,527. IGNITION TIMER. Lorenzo B. Shivers, Anglesea, N. J. Filed June 17, 1908. A circular casing has internal contacts engaged by a contact roller moving around a central shaft.

911,531. TELEPHONE APPARATUS. Charles H. Viggars and Ernest H. Stolz, Chicago, Ill.; said Viggars assignor to said Stolz. Filed January 13, 1908. The transmitter is made of a pair of electrodes, one of them formed of carbon having in its front face a number of cylindrical sockets, each containing a single row of carbon granules.

911,549. ELECTRIC RELAY. Fitzhugh Townsend, New York, N. Y., assignor to Samuel Marsh Young, New York, N. Y. Original application filed June 13, 1904. Divided and this application filed March 5, 1906. A selective relay comprises a fixed part having polar extensions, a movable part pivotally mounted between these extensions and having a coil thereon whose plane when in equilibrium will be that of the magnetic field between the polar extensions.

911,557. ILLUMINATING SIGN. Albert H. Hawkes, New York, N. Y. Filed October 19, 1907. Behind the sign characters is a series of inclined reflector slats that reflect outwardly the light from a single row of incandescent lamps at the bottom.

RE-ISSUE.

12,914. MECHANISM FOR GONGS AND THE LIKE. Henry E. Reeve, New York, N. Y. Filed December 16, 1908. Original No. 868,221, dated October 15, 1907. An electro-mechanical gong mechanism comprises a rotatable hammer shaft, a stop lever, a latch for same, and electromagnetically-operated means for releasing the latch.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired February 9, 1909:

468,388. ELEVATED ELECTRIC CONDUIT. C. O. Newton, Homer, N. Y.

468,414. ELECTRIC ALARM CLOCK. W. S. Burroughs, St. Louis, Mo.

468,416. DYNAMO-ELECTRIC MACHINE. G. E. Dorman, Chicago, Ill.

468,451. MAGNETO-ELECTRIC MACHINE. J. Hunt, New York, N. Y.

468,473. REPEATER FOR ELECTRIC CIRCUITS. M. G. Crane and F. W. Cole, Newton, Mass.

468,487. ELECTRIC-LIGHTING SYSTEM. S. L. Tripple, New York, N. Y.

468,492. ELECTRIC MOTOR TRUCK. F. O. Blackwell, Boston, Mass.

468,497. LIGHTNING ARRESTER. E. Thomson, Lynn, Mass.

468,500. SYSTEM FOR OPERATING GLOW LAMPS BY MEANS OF MULTIPHASE CURRENTS. J. F. H. Gorges, Berlin, Germany.

468,585. ELECTRIC CABLE. W. Vogler, Somerville, Mass.

468,597. ELECTRICAL INDICATOR. M. A. Deuel, Rochester, N. Y.

468,654. ELECTRIC CONNECTOR. G. Gibbs, Milwaukee, Wis.

468,686. ELECTRIC GOVERNOR. J. T. O'Brien, Kearney, Neb.

468,697. RESETTING DEVICE FOR ANNUNCIATORS. R. A. Schoenberg, New York, N. Y.

468,708. ELECTRIC RAILWAY. C. W. Thomas, Jersey City, N. J.

468,711. ELECTRIC ARC LAMP. A. G. Waterhouse, Hartford, Conn.

468,716. ELECTRIC MOTOR. J. T. Wilson, Tyrone, Pa.

468,752. RHEOSTAT. A. J. Shaw, Muskegon, Mich.

468,755. TELEGRAPHY. W. F. Wentz, Newark, N. J.